An Empirical Examination of IPO Underpricing in Chinese A-Share Market

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SUMMARY

Much evidence suggests that initial public offerings (IPOs) of common stocks are systematically priced at a discount to their subsequent initial trading price. The large underpricing magnitude in the Chinese IPO market has attracted much attention. Mok and Hui (1998) report an underpricing of 289% for a sample of 87 Shanghai IPOs listed from 1990 to 1993. Su and Fleisher (1999) find the underpricing level as high as 948.6% for Chinese A-share IPOs before January 1, 1996. A more updated report is from Tian (2003), who found an average of 267% of initial returns for IPOs from 1991 through 2000. These reported underpricing levels in the Chinese market are much higher than the average level of 60% in the emerging markets (Jenkinson and Ljungqvist, 2001). Despite many studies on the Chinese IPO underpricing, few studies have been done to investigate the reasons in light of classical IPO underpricing theories. Although previous studies such as Mok and Hui (1998), Su and Fleisher (1999), and Chau et al (1999) have explored some reasons for the high IPO underpricing, most of the studies examine a few aspects that may affect IPO underpricing. For many markets, whether developed or emerging, IPO underpricing may be explained in terms of some classical IPO underpricing models such as asymmetric information models, institutional explanations and ownership and control (see Jenkinson and Ljungqvist, 2001). Tests of the Chinese IPO underpricing against classical IPO underpricing models are, however, far from comprehensive. This paper attempts to shed light on this issue by examining some classical models of IPO underpricing for the Chinese market, especially some hypotheses not studied before.

The classical IPO underpricing models examined in this study are the winner's curse model (Rock, 1986), ex ante uncertainty hypothesis (Ritter, 1984; Beatty and Ritter, 1986) and the signaling model (Allen and Faulhaber, 1989; Grinblatt and Hwang, 1989; Welch, 1989, 1996). Among those tested classical models, the winner's curse model has not been tested before. The ex ante uncertainty hypothesis was tested by Mok and Hui (1998), but they test only one proxy of ex ante uncertainty, i.e. the inverse of new funds raised. We use three proxies-the standard deviation of after-market returns, the offer size and the age of firms, to examine the ex ante uncertainty hypothesis. In examining the signaling model, we test eight key empirical implications of the signaling model, some of which have been examined in Su and Fleisher (1999), but the methodology adopted and the conclusion made are different.

Using data from November 1995 to December 1998, our results show that the winner's curse hypothesis is the main reason for the high IPO underpricing in China. The signaling hypothesis does not stand in the Chinese market during the sample period.

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Chapter 1 Introduction

1.1 Motivation of the Study

- Much evidence suggests that initial public offerings of common stock (IPOs) are systematically priced at a discount to their subsequent trading price (for review of international evidence, see Jenkinson and Ljunqvist (2001)). In attempting to explain the puzzle, many academic researchers have formulated different models. But no single explanation can account for the apparent underpricing of new issues in all the stock markets. Even within one market, one model on its own might not be sufficient to account for the full extent of IPO underpricing.

- The last decades have seen phenomenal growth in the Chinese stock market both in the number o firms traded and dollar volume of shares traded, especially after early 1990s when the two stock exchanges were established (The Shanghai Stock Exchange (SHSE) in December 1990 and the Shenzhen Stock Exchange (SZSE) in July 1991).). As of December 2002, there are more than one thousand companies listed on the two exchanges, with total market capitalization equal to about 50 percent of China's gross domestic product (GDP). The combined market capitalization of the two stock exchanges has reached RMB[1] 3,832.9 billion and the negotiable share capital hits RMB 1,248.5 billion (more than that of Hong Kong, 1116.66 million HK$[2]). The

[1] RMB is the abbreviation for Renminbi, which is the basic unit for Chinese currency. RMB has been pegged the US dollar at the exchange rate of about RMB 8 per US$1 during the sample period being studied.

[2] The exchange rate from Hong Kong dollar to RMB is approximately 1.

size of the Chinese stock market has become comparable to those of the industrialized countries and thus cannot be ignored (Allen and Gale 1995). In addition, China joined the world trade organization (WTO) in November 2001. Opening up its securities market has been put into the schedule of the Chinese government. So an understanding of the characteristics and performance of the Chinese IPO market would be of great value for investors and scholars at home and abroad.

- The large underpricing magnitude in the Chinese IPO market has also attracted great attention. Mok and Hui (1998) report an underpricing[3] of 289% for a sample of 87 Shanghai IPOs listed from 1990 to 1993. Su and Fleisher (1999) find the underpricing level as high as 948.6% for Chinese A-share IPOs before January 1, 1996. A more updated report is from Tian (2003), who found an average of 267% of initial returns for IPOs from 1991 through 2000. These reported underpricing levels in the Chinese market are much higher than the average level of 60% in the emerging markets (Jenkinson and Ljungqvist, 2001). Despite many studies on the Chinese IPO underpricing, few studies have been done to investigate the reasons in light of classical IPO underpricing theories. Although previous studies such as Mok and Hui (1998), Su and Fleisher (1999), and Chau et al (1999) have explored some reasons for the high IPO underpricing, most of the studies examine few aspects that may affect IPO underpricing. For many markets, whether developed or emerging, IPO underpricing may be explained in terms of some classical IPO underpricing

[3] Underpricing is defined as the pricing of an IPO at less than its market value. A possible measure of the degree of underpricing is $(MV–P_0)/MV$, where P_0 is the offer price and MV is the firm's per-share market value on the offering date. Since MV is unknown on the offering date, many researchers use the initial return, $(P_1–P_0)/P_0$, where P_1 is the first-day closing price, as a measure of underpricing. We shall adopt this terminology in this paper.

models such as asymmetric information models, institutional explanations and ownership and control (see Jenkinson and Ljungqvist, 2001). Tests of the Chinese IPO underpricing against classical IPO underpricing models are, however, far from comprehensive. This paper attempts to shed some light on this and examines a list of classical models of IPO underpricing for the Chinese market using data from November 1995 to December 1998.

1.2 Objectives of the study

Given the above motivation, this study has two major objectives.

The first objective is to record the level of underpricing for IPOs in China over a relatively more current period. With this in mind, IPOs are examined in this study over period from November 1995 to December 1998. To filter out effects of offering methods on underpricing, I examine only the most commonly used online fixed pricing offerings (Shang Wang Ding Jia) in China. In total, 343 IPOs are analyzed over the period of interest.

The second and perhaps more important objective of this study is to investigate possible explanations for the level of underpricing recorded, across various issues. This second area of study draws largely upon the existing models of IPO underpricing. I review the theoretical IPO underpricing models and analyze possible model explanations for the cross sectional difference in Chinese IPO underpricing. Based on possible explanation models and related literature, hypotheses are formulated and tested. The classical IPO underpricing models examined in this study are the winner's curse model (Rock, 1986), ex ante uncertainty hypothesis (Ritter, 1984; Beatty and

Ritter, 1986) and the signaling model (Allen and Faulhaber, 1989; Grinblatt and Hwang, 1989; Welch, 1989, 1996).

By investigating the IPO phenomenon in the Chinese market, I hope to provide further insights on international IPO underpricing.

1.3 Contribution of the study

- Among those tested classical models, the winner's curse model[4] has not been tested before. The ex ante uncertainty hypothesis was tested by Mok and Hui (1998), but they test only one proxy of ex ante uncertainty, i.e. the inverse of new funds raised. We use three proxies-the standard deviation of after-market returns, the offer size and the age of firms, to examine the ex ante uncertainty hypothesis. In examining the signaling model, we test eight empirical implications of the signaling model, some of which have been examined in Su and Fleisher (1999), but the methodology adopted and the conclusion made are different.

- My results show that investors' high ex ante uncertainty about firm's value and the winner's curse problems are the main reasons for the high IPO underpricing in China. But the signaling hypothesis does not stand in the Chinese market during the sample period.

- Given the prominence of the Chinese stock market in the emerging markets, the results should be able to shed some light on IPO underpricing for other

[4] Wu (2001) finds a positive correlation between underpricing and allocation rate in China, which is in support of the winner's curse model. However, other key implications of the winner curse model were not tested. Therefore it can not be considered as a complete test of the Winner's Curse's model in the Chinese market.

emerging markets and provide further insights on international IPO underpricing. The results add more evidences on testing of the winner's curse and signaling model as well. This should be illuminating and of value to both academicians and practitioners.

1.4 Structure of the study.

The rest of this paper is organized as follows. Chapter 2 summarizes the theoretical literature on IPO underpricing and provides a survey on Chinese primary market. Chapter 3 formulates the hypotheses to be examined and methodology adopted. Chapter 4 describes data and reports empirical results. Chapter 5 summarizes and concludes.

Chapter 2 Models of IPO Underpricing and a Survey of Chinese Primary market

2.1 Models of IPO underpricing

It has been a well-know empirical regularity in the IPO market that companies apparently underprice their shares when going public. Previous studies have shown a phenomenon of underpricing in virtually every country. The first day premium that investors experience is on average more than 15 percent in industrialized countries and around 60 percent in emerging markets (Jenkinson and Ljunqvist, 2001).

In an efficient and perfect market, theory suggests, companies should not 'leave money on the table', certainly not in such large quantities. In trying to explain why firms are floated at too low a price, researchers have generated a large theoretical and empirical literature. Jenkinson and Ljunqvist sum up most of the studies on IPO underpricing in their book *Going Public* (Second Edition 2001). Briefly the IPO underpricing models include the following (refer to the book for details of each model):

2.1.1 Asymmetric Information

The most important modern theories of IPO underpricing arise from important informational asymmetries between market participants, the issuing firm, the

underwriting distribution syndicate, the initial buyers and the larger set of investors in the secondary market.

Most models of IPO pricing typically assume one group has superior information on firm value. Other agents know this and behave accordingly. Further everyone knows that everyone knows this, and so on ad infinitum.

There are four informational assumptions one might make which accordingly lead to the four underpricing models.

a) Assume a small group of investors has information superior to that of other investors and the issuer

Rock's (1986) asymmetric information model assumes that there are two groups of potential investors in the IPO markets: (1) 'informed' investors, those prepared to incur evaluation costs to assess the after-market performance of the offering and bid only of attractively priced IPOs; (2) 'uninformed' investors do not commit resources to acquire information and apply for every new issue coming into the market indiscriminately. Thus uninformed investors face competition for good shares, but have a higher probability of obtaining bad shares due to the rationing mechanism applied to oversubscribed offerings. Rock argues that the bias in rationing produces an equilibrium offer price with a finite discount sufficient to attract uninformed investors to the issue (assuming that the primary market is dependent on the continued participation of uninformed investors, in the sense that informed demand is insufficient to take up all shares on offer even in attractive offerings). This does not remove the allocation bias against the uninformed – they will still be crowded out by informed investors in the most underpriced offerings – but they will no longer make losses on average, even after adjusting for rationing. This gives rise to the "Winner's

Curse" or "Adverse Selection" models. Implicit in the winner's curse model is the notion that, if properly adjusted for risk and rationing, uninformed investors' abnormal returns are zero, on average – that is just enough to ensure their continued participation in the market. Similarly, the informed investors' conditional underpricing return should just provide a normal return on their information production. While the former is potentially testable, the latter is not, not least because informed and uninformed investors cannot in practice be distinguished. Moreover, very few markets publish enough allocation data to allow underpricing returns to be adjusted for rationing. The evidence from countries use fixed price rather than book-building mechanisms, mostly supports the presence of a winner's curse: in Singapore, the UK, and Finland initial returns do indeed tend to be zero when adjusted for rationing.

b) Assume the issuer has better information on securities value than do the underwriter or investors.

If the issuing firm is better informed about the present value and risk of its future cash flows than are investors or underwriters, underpricing may become a mean of convincing potential buyers of the "true" high value of the firm, i.e. underpricing as a signal of firm quality. Allen and Faulhaber (1989), Grinblatt and Hwang (1989), and Welch (1989, 1996) have contributed theories of this underpricing signaling model. They hypothesize that underpricing allows "good" firms to distinguish themselves from "bad" firms and to improve terms of future external financing.

Under this assumption, good quality issuers are assumed to maximize the expected proceeds of a two-stage sale: they sell a fraction of the firm at flotation and the remainder in a seasoned equity offering, henceforth, SEO. In the words of Ibbotson (1975), issuers underprice in order to 'leave a good taste in investors' mouths'. With

some positive probability, a firm's true type is revealed before the post-IPO financing stage, introducing the risk to low-quality issuers that any cheating on their part will be detected before they can reap the benefit from the signal. This makes separation possible, in that it decreases the expected benefit from signaling to low-value firms and thus drives a wedge between high-value and low-value firms' marginal signaling cost. Signaling true value is beneficial to a high-value company as it allows a higher price to be fetched at the second-stage sale if separation is achieved.

c) Assume underwriters /distributors possess information superior to the issuer

In the previous two models, underwriters do not have any particular role and thus potential agency problems between the underwriter managing the floatation and the issuing firm are ignored. Now if underwriters are better informed about investor demand than issuers, underwriters may earn information rents in an imperfectly competitive underwriter market, for instance in the form of sub-optimal selling effort. When the underwriter has valuable private information on market demand, the issuer will wish to learn this information. But the issuer must offer incentives to underwriter to truly reveal it. In order to secure truthful revelation of private information and encourage promotion efforts, the issuers may agree to a contract that leads to underpricing. This leads to the *Principal-Agent* models of the IPO.

Baron and Holmstrom (1980) and Baron (1982) construct a screening model which focuses on the lead manager's benefit from underpricing. In a screening model, the uninformed party offers a menu or schedule of contracts, from which the informed party selects the one that is optimal given her unobserved type and/or hidden action. The contract schedule is designed to optimize the uninformed party's objective, which, given his informational disadvantage, will not be first-best optimal.

To induce optimal use of the underwriter's superior information about investor demand, the issuer delegates the pricing decision to the bank. Given his information, the underwriter self-selects a contract from a menu of combinations of IPO prices and underpricing spreads; if likely demand is low, he selects a high spread and a low price, and *vice versa* if demand is high[5]. This optimizes the underwriter's unobservable selling effort by making it dependent on market demand. Compared with the first-best solution under symmetric information, the second-best incentive-compatible contract involves underpricing in equilibrium, essentially since his informational advantage allows the underwriter to capture positive rents in the form of below-first-best effort costs.

d) Assume institutional investosrs know more than the issuer about the prospects for the company's competitors or the economy as a whole. Individual investors know their own demand while the underwriter doesn't know

Benveniste and Spindt (1989) suggest that a key function of the investment bank that takes a company public is to elicit information from better-informed investors. In signaling models, issuers have the informational advantage. However it seems plausible that there is an information asymmetry running in the other direction. Institutional investors may know more than the issuers about the prospects for the company's competitors or the economy as a whole because they are exposed to the flow of IPOs on a continuous basis. And even the least well informed investor knows something the issuer doesn't: her own demand for the shares. So while the issuers know their own particular pieces of the jigsaw better than anyone else, investors hold other pieces of the same jigsaw which when put together give a clearer picture of the

[5] There is empirical support for the notion of a menu of compensation contracts. Dunbar (1995) shows that issuers successfully offer underwriters a menu that minimizes offering costs by inducing self-selection.

value of the company. The task of the underwriter is then to acquire as many jigsaw pieces as possible before setting the offer price.

Underwriters underprice the issue in this case to elicit information from better-informed investors. This forms the *information revelation theories*. But why would investors cooperate and reveal their information, especially when the information is positive? Benveniste and Spindt (1989) show that book building is a mechanism that induces investors to reveal their information truthfully. In book building, the book contains investors' indications of interest (which can take the form of price-quantity bids, unlimited bids, or 'soft' information such as 'give me what you've got'). These indications of interest can communicate the various jigsaw pieces the investors hold. To make sure that they do, the underwriter offers a stick and a carrot. The stick is that any investor who claims that here jigsaw piece looks unfavorable is allocated no or only very few shares. This mitigates the incentive to mispresent positive information. The carrot is that any investor who claims her jigsaw piece looks favorable (for instance via an aggressive indication of interest, such as bidding for a large quantity at a high price) is rewarded with a disproportionately high allocation of shares. Taken together, the stick and the carrot can ensure that an investor is never better off claiming bad news when the news is in fact good.

To make sure this mechanism work, the underwriter underprices the issue. Effectively, an investor's monetary reward for truthful reporting equals the number of shares allocated times dollar underpricing.

One common empirical implication among three of the above asymmetric information models is that underpricing should increase in the *ex ante* uncertainty surrounding the intrinsic value of an IPO (Beatty and Ritter 1986). Winner's curse model explains that

an investor who decides to engage in information production implicitly invests in a call option on the IPO, which she will exercise if the 'true' price exceeds the strike price, the price at which the shares are offered to the public. The value of this option increases in the extent of valuation uncertainty, so more investors will become informed. This raises the required underpricing, since an increase in the number of informed traders aggravates the winner's curse problem. Signaling model says that a noisier environment increases the extent of underpricing that is necessary to achieve separation. And principal-Agent model implies the same because the more uncertain the value of the firm, the greater the asymmetry of information between issuer and underwriter, and thus the more valuable the underwriter's services become, resulting in greater underpricing.

2.1.2 Institutional Explanations

There are two main institutional underpricing models.

a) Legal insurance hypothesis of underpricing

The basic idea is that companies knowingly sell their stock at a discount to insure against further lawsuits from shareholders disappointed with the performance of their shares. In countries with stringent disclosure rules, underwriters and issuers are exposed to considerable litigation risk. Lawsuits are costly to the defendants, not only directly- legal fees, diversion of management time, etc.- but also in terms of the potential damage to their reputation capital. Tinic (1988) and Hughes and Thakor (1992) argue that intentional underpricing may act as insurance against such securities litigation.

b) Price Support

Temporary price support in IPOs is legal in many countries including the USA, the UK, France, Germany, Greece and the Netherlands. In these countries underwriters can support prices by stimulating demand or by restricting supply in the after-market. They can stimulate demand either by posting bids at or below the offer price (stabilizing bids), or by actively buying back shares of weak offerings (stabilizing trades). Although inventory positions expose underwriters to considerate risk, Ellis *et al*. (2000) show that underwriters use their short positions to manage inventory risk. Underwriters typically oversell IPOs, by allocating 115 percent of shares on offer. If prices subsequently rise, they can cover their short position by exercising the over-allotment option to buy another 15% of share from the issuer; if prices fall, they leave the over-allotment option unexercised and close out their short position by open-market purchases instead. Either way, they make a profit. Ellis *et al* find that price support is not costly to underwriters because, as market makers, they earn trading commissions that are large enough to offset any losses they might suffer on their inventory. Trading profit, on the other hand, increase in initial underpricing, which might give underwriters an incentive to increase underpricing.

Ruud (1991, 1993) argues that underwriters do not underprice deliberately and underpricing is a byproduct of price support. His starting point is from the statistical regularities of initial returns. Rather than forming a symmetric distribution around some positive mean, initial returns typically peak sharply at zero, are highly positively skewed, and include few negative observations. Ruud explains that underwriters price IPOs at expected market value and support those offerings whose prices fall below the offer price in after-market trading. Such behavior would tend to eliminate the left tail of the distribution of initial returns, and thus lead to the observation of a positive

average price jump. According to Ruud, if price support suppresses the negative tail of the initial return distribution, companies merely appear to be underpriced on average.

Asquith *et al*. (1998) investigate whether observed underpricing is a byproduct of price support. If Ruud is correct in saying that there is no deliberate underpricing, then the initial return distribution of unsupported offerings should have a mean of zero. This, however, is not what Asquith *et al* find.

Ruud's statistical view leaves many economic questions unanswered, such as why underwriters would want to provide price support. A number of studies such as Schultz and Zaman (1994), Prabhala and Puri (1999), Hanley *et al* (1993) and Benveniste *et al* (1996) offer different explanations of why underwriters provide price support, which will not be described in detail here.

2.1.3 Ownership and Control

Going public is, in many cases, a step towards the separation of ownership and control. Ownership matters for the effects it can have on the management's incentives to make optimal operating and investment decisions. In particular, where the separation of ownership and control is incomplete, an agency problem (Jensen and Meckling 1976) between non-managing and managing shareholders arises: managers may maximize the expected private utility of their control benefits at the expense of outsiders, rather than maximizing expected shareholder value.

Two principal models have sought to rationalize the underpricing phenomenon within the bounds of an agency cost approach. Their predictions are diametrically opposed: while Brennan and Franks (1997) view underpricing as a means to entrench managerial control and the attendant agency cost by avoiding monitoring by a large

outsider shareholder, Stoughton and Zechner's (1998) analysis instead suggests that underpricing may be used to minimize agency costs by encouraging monitoring.

a) Underpricing as a Means to Retain Control

Brennan and Franks (1997) develop a model in which underpricing gives managers a means to protect their private control benefit by allocating shares strategically when taking their company public. Managers would wish to avoid a single investor assembling a large stake for fear that their non-value-maximizing behavior would receive unwelcome scrutiny. By deliberately underpricing the flotation, they can ensure that the offer is over-subscribed and that investors will need to be rationed in their allocations. Rationing allows managers to discriminate between applicants of different sizes and so to reduce the block size of new shareholdings.

b) Underpricing as a Means to Reduce Agency Costs

There is one hidden assumption in Brennan-Franks' model that managers try to maximize their expected private utility by entrenching their control benefit. Actually managers may wish to allocate the issue in a way that minimizes, rather than maximizes their scope for discretion. Managers are part –owners of a company, they bear some of the costs of their own non-profit maximizing behavior. Stoughton and Zechner (1998) observe that, in contrast to Brennan and Franks, it may be value enhancing to allocate shares to large outsider investor who is able to monitor managerial actions. Monitoring is a public good. Since any large shareholder will monitor only in so far as this is privately optimal, there will be underinvestment in monitoring from the point of view of both shareholders and incumbent managers. To encourage better monitoring, managers may try to allocate a particularly large stake to an investor.

Different models explain different situations in different countries. Some models are not possible explanations for IPO underpricing in a particular country because of the country's stock market characteristics. The Chinese stock market characteristics determine that some IPO underpricing models do not apply in China, but the characteristics do provide a unique situation where certain pmodels can be relatively clearly examined. Section 2.2 describes features of the Chinese primary market; section 2.3 summarizes previous studies on the Chinese IPO underpricing. In section 2.4, I will analyze comprehensively which classical IPO underpricing models are possible explanation for Chinese IPO underpricing according to the Chinese market features and previous findings.

2.2 Features of the Chinese Primary Market

2.2.1 The pre-offer process

The IPO decision in China is made on the basis of political considerations as well as profitability considerations. Every year, the Chinese authorities (the State Planning Committee, the Central Bank, and the China Securities Regulatory Commission) determine the total number of issues allowed and which firms can make issues.

The process begins when the State Planning Commission lays out its annual financing plan for state enterprises. After the calculations and political balancing, a total figure representing capital to be raised by all listings is entered into the State Plan regardless of market conditions. The non-state sector has seldom been included in the thinking about which enterprises should be enabled to finance through the sale of securities. Thus equity financing for Chinese companies via either the domestic or the international markets, has been mostly for State Owned Enterprises (SOEs). So the

listing process in China is also a process of restructuring and packaging SOEs into shareholding companies and a process of privatization.

Once the China central authorities have set the overall quota, each province is allocated a sub-quota. The stated criteria used for allocation of new issues among provinces reflect the central security regulatory authorities' perceived regional development needs and provincial differences in production structure and industrial base. Within each regional quota, the local security regulatory authorities invite enterprises to apply a listing and make a selection based on some criteria[6]. These criteria include the performance and sectoral development objectives of the enterprise. Local government selection criteria take into account the profitability and performance criteria of the exchanges.

Once approval for an issue has been obtained an investment syndicate will be formed to draw up a detailed plan. Securities companies will perform the standard services of providing advice, underwriting and distributing shares to the public, as well as developing a secondary market in them. The underwriting market in China is relatively competitive and there are 129 firms providing underwriting services. Table 2.1 shows that the top ten underwriters occupy 64.8 percent of the IPO market. All of them are state owned companies and most of them are associated with the government and are very well connected to the regulation authority (Tian L. G. 2003). A-share issues are underwritten by domestic brokerage firms owned by the state, foreign share

[6] A prerequisite for firms to get floated is to satisfy the conditions stipulated in the Company Law. The conditions stipulated in the Company Law enacted in December 1999 are:

i. Total share capital not less than RMB 50 million
ii. With an operating history of at least three years and a continuous profitability over the past 3 years.
iii. No less than 1000 shareholders holding shares paper-valued RMB1000 or above; More than 25 percent of total shares offered to the public.
iv. No lawbreaking activities or dishonest accounting report in the past three years.

issues are underwritten by prestigious financial institutions with international reputations.

Table 2.1 Main Underwriters and their performance (1991-2001)

	Underwriters	Under-written Firms	Underwritten shares (1,000)	Market Share (%)	Main sponsors
1	Guotai Jun'an Securities Co.	238	1560.2	15.8	Central Bank
2	Shenyin Wan'guo Securities Co.	182	930.1	9.42	Shanghai Govt.
3	Nangang Securities Co.	123	824.3	8.35	Central Bank
4	Huaxia Securities Co.	81	600.8	6.08	Central Bank
5	CITIC Securities Co.	62	499.5	5.06	State Council
6	Haitong Securities Co.	81	487.7	4.94	Shanghai Govt.
7	Guangfa Securities Co.	79	433.5	4.39	Guangdong Govt.
8	Everbright Securities Co.	54	394.4	3.99	State Council
9	Gousen Securities co.	63	338.9	3.43	Shenzhen Govt.
10	United Securities Co.	25	329.9	3.34	37 National SOEs

Source: Tian L. G. (2003)

2.2.2 Type of Shares in the Chinese stock market

In the privatization process, the Chinese government introduced 5 major categories of shares to allow ownership of state-owned enterprises to be dispersed among the government itself, state-owned enterprises, firm's own employees, domestic public and foreign investors.

(1) State shares, which are owned by the state and its various ministries, bureaus and regional governments. They are not tradable.

(2) Legal entity shares, which can only be held by State-Owned Enterprises and/or the foreign partner of a corporatized joint venture. These shares are highly illiquid. They cannot be listed in the two official exchanges (SHSE and SZSE), but they can be sold to other legal entities through the nation-wide computerized system called STAQS (the Security Trading and Automatic Quote System), which was first introduced in July 1992.

One distinguishing 'Chinese characteristic' is that the majority shareholding of equities are non-negotiable government shares and legal entity shares. In my sample of 343 IPOs from Nov 1995 through Dec 1998, 65% of A-shares outstanding are held by the state and the legal entities. Individual investors own only 35% of shares. This means that, on average, only about 35% of total shares outstanding are traded publicly on either the SHSE or SZSE.

(3) Employee shares, which are those shares issued by the listed company and offered to managers and employees prior to those offered to the public. These shares are initially prohibited from trading for a certain period of time (typically 6 months or 3 years in China). After that they become tradable A-shares.

(4) Ordinary domestic shares or A-shares designated only for private Chinese citizens and traded on SHSE and SZSE. In terms of size and level of activity, the *A*-share market dominates China's equity markets. *A*-shares can only be bought and sold by individual or legal persons within the PRC and are RMB dominated. Overseas investors are not permitted to purchase *A*-shares unless they purchase authorized joint venture mutual funds.

(5) Foreign shares, designated only for foreign investors to be traded on security exchanges in China (B shares), in Hong Kong (H shares) or on the NYSE (N shares)[7].

2.2.3 The Issuing Mechanism

In established markets three methods are normally used in making initial public offerings, fixed price, book building and auction. In China, the offering mechanism adopted is mainly fixed price offerings, but it is quite complicated and different from those of developed markets.

[7] The B-share market was opened to the domestic residents on 19 February 2001.

The share offering mechanism in China has gone through several stages of reforms (see Appendix A). The most commonly used method after 1995, however, is the online fixed price offering methods called 'Shang Wang Ding Jia'. This online fixed price offering method[8] was first introduced in 1994, in which investors bid for quantities, with pro-rata allocation in the event of oversubscription. Investors need to pay a full subscription deposit but with repayment for unsuccessful applicants around one week after subscription. This offering method has proved a more efficient procedure and meets with the approval of investors. It has become the major offering method from 1996 till the year 2002.

The offer price in the fixed price offering is chosen according to the formula of taking the after tax profits per share multiplied by a price earning ratio (PE), the latter being set in relation to the price earnings ratios of listed companies in the same locality and industry. However, The PE ratio changes in accordance with the guidance of CSRC (China Securities Regulatory Commission). Otherwise the IPOs will not get approval. The CSRC often imposes a ceiling on the PE ratio, which prevents prices from being set in relation to an individual firm's characteristics and growth potential. Moreover the ceiling changes over time. Before 1999, the ceiling level was controlled at 15. In January 1999, the ceiling restriction was loosened and the PE ratio used in IPO pricing raises to as high as 50 until the year 2002 when a ceiling of 20 was re-imposed. Not

[8] In the online fixed price offering, the lead underwriter uses the exchange trading system to sell new stocks at a fix price and investors apply new stocks through the existing buy order at a designated time. Investors must have one stock account and one cash account and enough full payment funds deposited in their cash account prior to application. The number of shares applied must be in whole lots. A lot is 1,000 shares.
The application movement is like this:
1st day Investors apply
2nd-3rd days Exchange validates investors' deposit funds and allocates one serial number to each lot applied and investors affirm their application serial numbers.
4th day Lead underwriter organizes balloting
5th day Lead underwriter publicizes the balloted winning serial numbers on designated papers. Investors make payment for their successful applications and the rest part are refunded.

only the PE ratio affected by the authority's policy, but also the after-tax profits per share used in the IPO pricing. For example, from end 1995 to February 1997, the regulated after-tax profit took the average level of one year before IPO and the IPO year; from March 1997 to February 1998, the after-tax profit adopted the three year average prior to IPO; while from February 1998 to March 1999, the after-tax profit per share equals to the estimated after-tax profit per share for the IPO year.

In the fixed price offering, pro-rata allocation is used to allocate the overwhelming applications. But the pro-rata allocation in China takes the form of random allocation rules, where balloting chooses the investors. The ballot ratio used equals to the number of shares publicly offered divided by the number of shares investors subscribed. Therefore there is an inverse relation between the demand for new issues and the allocation rate.

2.2.4 Supervision and Regulations

One requirement for a well-functioning market concerns supervision and this may be provided through government legislation and/or internal regulation. Reliable and fair trading procedures can increase investors' confidence and help safeguard their interests. During the period under study, the State Council Securities Commission (the "SCSC") and the China Securities Regulatory Commission (the "CSRC") were responsible for supervising and regulating the securities market. The SCSC, established in October 1992, is the State authority responsible for exercising centralized market regulation. The CSRC, also established in October 1992, is the SCSC's executive branch responsible for conducting supervision and regulation of the securities markets in accordance with the law and regularities. In November 1998, the Central People's Government held the National Finance Conference and decided to

reform and reorganize the national securities regulatory mechanism. The local securities regulatory departments will be supervised directly. Organizations engaged in securities formerly supervised by the People's Bank of China were put under the centralized supervision of the CSRC. But it was until July 1999 the first securities law was enacted, which provided a consistent legal framework for the securities industry and stock market in China. In general, before 1999, in terms of supervision and regularities, the Chinese stock market is immature, compared with a fully-fledged stock market in a developed market.

2.2.5 Other Characteristics Related to This Study

In China, almost all IPOs are oversubscribed (in my sample of fixed price offerings, there is no under subscription) due to an extremely high demand relative to its limited supply of new issues. Before the emergence of stock markets, Chinese households had access to a very limited number of investment instruments, mainly savings deposits at relatively low interest rates. Miurin and Sommariva (1993) describe how the lack of consumer goods and financial instruments forced Chinese individuals to invest in fixed-rate bank deposits that provide a negative real return during inflationary period that started in the early 1980s. At the same time, China's household savings rate was one of the world's highest, about 40 percent of total disposable income. Chen (1995) reports the results of surveys of Chinese citizens indicating that about 80% of the respondents desired to participate in the market but was unable to do so. Of those investors in the market, about 83 percent indicated the intention to increase their stock investment. On the other hand, the aggregate value of new shares to be issued is limited by the national investment and credit plan. Therefore there has been a persistent demand for new shares in China.

It is also noteworthy that seasoned equity offerings (SEOs) are very frequently observed among Chinese issuers and that SEOs account for a substantial portion of shares issued. About 91percent of the Chinese firms that went public before 1 July 1994 issued seasoned equities before 1 January 1996 (Su and Fleisher, 1999). Kim et al (2000) also reports that in their sample IPOs from 1992 through 1995, approximately 64 percent go back to the market to raise additional equity capital in the three years after IPO.

Another characteristic of the Chinese stock market related to my study is that the accounting report and market regulatory system in China are relatively primitive and incomplete (Aharony et al., 2000; Xiang, 1998). The auditing standards in Chinese stock market are also generally perceived to be low (Aharony et al 2000). There is far less corporate disclosure in China than that of developed countries. Private investors' major source of information is the IPO prospectuses, which unfortunately are not reliable under the existing accounting and auditing standard. This makes individual investors difficult to evaluate an IPO before investing. Furthermore *A*-shares are sold to relatively unsophisticated private individual investors who usually do not commit much time and recourses on IPO firm evaluation (while B shares are sold primarily to international institutional investors such as foreign mutual funds). Therefore investors lack information about the true quality of the firm going public and there are big ex ante uncertainties about the issuing firm's value.

2.3 Prior Studies of the Chinese IPO underpricing

There are some papers documenting the extraordinarily high underpricing of Chinese IPOs. Table 2.2 presents a survey of these studies. Using different data sets, these

papers report the mean initial returns range from 127 percent to 949 percent and present a number of determinants of underpricing, including time gap, offering size, issuer's fractional ownership etc. Most of the studies examine only a few determinant factors instead of testing the classical IPO underpricing models comprehensively except that Mok and Hui examined the ex ante risk and Su and Fleisher examined the signaling model. Mok and Hui find that the high equity retention by the state, a long time-lag between offering and listing and ex ante risk of new issues were key-determinants of market adjusted IPO underpricing. Su and Fleisher examined the signaling model comprehensively and find that the Chinese IPO underpricing is a strategy for firms to signal their value to investors. They also investigate the effect of offering mechanism on IPO underpricing and find that IPO underpricing is the largest under the lottery with a fixed number of lottery-forms and is the smallest under the auction mechanism. Wu (2001) reports that subscription rate in China is positively related to IPO underpricing in support of winner's curse model. She also finds that there is no significant relationship between the underwriter's reputation and the degree of IPO underpricing. A more recent study by Tian (2003) argues that the listing quota and pricing caps imposed by the government are major determinants of Chinese IPO underpricing.

Table 2.2 Prior studies of the Chinese IPO underpricing

Papers	Sample size	Sample period	Average Initial Return (%)	Findings pertaining to the explanations of the IPO underpricing
Mok and Hui (1998)	87	1990-1993	289	The high equity retention by the state, a long time-lag between offering and listing and ex ante risk of new issues were the key-determinants of the underpricing.
Kim et al (1998)	45	1993	594	IPOs for which a larger percentage of total shares are sold to individual investors are more underpriced and IPOs of firms that are expected to have larger increases in profitability are less underpriced , which is consistent with the political persuasion hypothesis.
Su and Fleisher (1999)	101	1987-1995	949	The signaling hypothesis explains the pattern of underpricing behavior rather well. In examining the effect of the offering mechanism on IPO underpricing they find the underpricing to be the largest under the lottery with a fixed number of lottery-forms and is the smallest under the auction mechanism.
Chau et al (1999)	102	1990-1993	546	Investors in previously centrally planned economies view agency costs as a consideration in investment; Initial returns are smaller when the government retains a large proportion of ownership and initial returns are negatively related to firm size. Investors rely on insider ownership to reduce agency costs.
Chen et al (2000)	277	1992-1995	350	The state underprices to ensure future seasoned equity issues to be successful; The long-time lag from the offering date to the first trading date explain the high underpricing; A-share IPOs that subsequently make rights issues are significantly more underpriced.
Wu (2001)	840	1990-2000	218	Subscription rate is positively related to IPO underpricing; there is no significant relationship between underwriter's reputation and underpricing;
Chi and Padgett (2002)	340	1996-1997	127	The quota system for new issues is the main reason for the underpricing
Tian (2003)	1124	1991-2000	267	The listing quota and pricing caps imposed by the government account for more than half of the severe underpricing. Information on the quality of the firm causes IPO underpricing, but it is not a major determinant. Besides the effects of the financial regulations, Chinese-specific investment risks also contribute to severe underpricing. The long time lag from the IPO date to the first trading date causes the underpricing.

Note: This table describes only studies on the Chinese IPO underpricing. Research on other aspects of the Chinese stock market such as the long term IPO after-market performance, the development of China's privatization program, the price behavior of listed companies, or the relationships between company value and accounting earnings and book values is not included. Among the papers listed, only findings of relevant points are summarized.

2.4 Possible Explanations for Chinese A-share IPO Underpricing

The Chinese stock market characteristics determine that some IPO underpricing models do not apply in China, but the characteristics do provide a unique situation where certain models can be relatively clearly examined as well.

As shown above that the major offering mechanisms in China does not have any pricing or rationing bias. This suggests that the first two models of ownership and control will not apply since these two models need rationing discrimination as means to realize the control ends.

In the Chinese IPO market, there is no book building offering mechanism until the year 2001, therefore information revelation can't possibly explain the high level of underpricing, at least before 2001.The lawsuit idea is a US-centric model, which fails in the international context: underpricing is a global phenomenon, while strict liability laws are not. The risk of being sued is not economically significant in Australia (Lee *et al*. 1996), Finland (Keloharju 1993*b*), Germany (Ljungqvist 1995*a*), Japan (Beller *et al.*1992, Macey and Kanda 1990) Sweden (Rydqvist 1994), Switzerland (Kunz and Aggarwal 1994), or the UK (Jenkinson 1990), all of which experience underpricing. As an emerging stock market, China did not have a complete securities law in force until July 1999; the risk of being sued is not economically significant. Therefore the lawsuit hypothesis does not apply here. Price support is prohibited in Chinese stock market; neither can price support underwritten underpricing explain the Chinese IPO underpricing.

As to the principal-agent hypothesis, on one hand underwriters do not have much of market power to seek the information rent because of the competition in the Chinese

underwriting line; on the other it is not a problem for underwriters to place all available stock with investors due to the extremely high demand. In western countries, securities companies underwrite stock issues at a price decided through negotiation with the issuing company. There is a risk involved in the underwriting: when securities companies fail to sell all the stocks they purchase, they have to lower the selling price since according to the regulations in some countries they cannot hold these unsold stocks. It is thus of vital importance for the underwriter to get the right price for the stock they underwrite. In China things are different. Although like their western counterparts, the Chinese issuing companies also preferred to have a high premium price for their shares, the securities companies in China are, however, willing to do so in order to attract more business. This is because the demand for shares is always high. There is no risk of shares being unsold, and even if such a risk does exist, the unsold shares could always be stored for future sale. So getting underwriting contracts can almost guarantee profit for securities companies. Therefore, without rent seeking or moral hazard problems, the principal-agent model cannot possibly explain the Chinese IPO underpricing.

Winner's curse problem is a possible explanation for Chinese IPO underpricing. There are mainly two types of investors in the Chinese stock market: individual investors and institutional investors. Table 2.2 shows the structure of investors as of 1998. The vast majority of investors in the Chinese market are individuals who can be regarded as uninformed investors. The small portion of institutional investors might function as informed investors.

(In thousands)

Table 2.3 The Structure of Domestic Investors in 1998

	Shanghai	Shenzhen	Total

Institutional Investors	62.6	93.2	155.8
Individual Investors	19927.1	19024.1	38951.2
Total	19989.7	19117.3	39107

Source: China Security Year Book 1999

Rock's winner's curse model is examined only in countries where there are data on allocation rate to subscribers (Koh and Walter, 1989; Levis, 1990; Keloharju, 1993; Amihud et al, 2003). Fortunately we are able to have the allocation data in China. As described before, In China, all applications of different sizes have an equal probability of being accepted and the probability (ballot ratio) is publicly announced after IPOs. This feature enables us to examine the adverse selection model in the Chinese market.

Due to weakness in disclosure and auditing standards, investors lack information about the true quality of the firm going public. A relatively high degree of investor uncertainty affects the IPO pricing. As mentioned before, the Winner's Curse model, the signaling model and Principal-Agent model all suggest a positive correlation between ex ante uncertainty and underpricing. Mok and Hui (1998) argue that proxies for ex ante uncertainty explains the pattern of *A*-share IPO returns for a sample of 87 Shanghai firms that went public during the years 1990-1993. Thus ex ante uncertainty could also be one of the main reasons for Chinese IPO underpricing.

High degree of investor uncertainty also means that the information asymmetry between the investors and the issuers is high. This provides incentives for good quality issuers to underprice to signal their firm value. Moreover the frequent observation of SEOs among Chinese issuers also proves that signaling might be a good explanation for underpricing. Su and Fleisher (1999) find that the signaling hypothesis explains the pattern of underpricing behavior among Chinese issuers rather well. Their findings

in support of the signaling hypothesis are: 1) the correlation between the degree of IPO underpricing and initial offer price for the proportion of the firm offered to the public is negative, given the issuer's retained ownership. 2) the degree of IPO underpricing is positively related to proxies for the issuer's intrinsic value, the variance o future returns, and the issuer's fractional ownership. 3) issuers with larger IPO underpricing are more likely to raise larger amounts of capital through SEOs and to do so more quickly than issuers with a smaller degree of IPO underpricing, although the latter relationship is weak. Mok and Hui (1998) also find a positive relationship between the issuer's ownership and IPO underpricing in support of the signaling hypothesis.

In summary of chapter 2, the IPO underpricing literature has provided rich explanations for the financial anomaly of IPO underpricing. These underpricing models are mainly divided into three categories: asymmetric information, institutional explanations and ownership and control explanations. Considering the situations in the Chinese market, I eliminate all models under the last two categories. Among the asymmetric information explanations, I narrow down the possible Chinese IPO underpricing explanations to the winner's curse model, ex ante uncertainty explanation and the signaling model. In the rest of the study I am going to focus on examining the winner's curse model, ex ante uncertainty explanation and the signaling model in the Chinese *A*-share market among which the winner's curse model[9] has not been examined before. The ex ante uncertainty hypothesis was tested by Mok and Hui (1998), but they tested only one proxy for ex ante uncertainty, i.e., the inverse of new funds raised. We consider 3 proxies–the standard deviation of after-market returns, the

[9] Wu (2001) finds a positive correlation between underpricing and allocation rate in China in support of the winner's curse model. But other key implications of the winner curse model were not tested. Therefore it is not a complete test of the winner's curse model.

offer size and the age of firms, to examine the ex ante uncertainty hypothesis. In examining the signaling model, we test eight empirical implications of the signaling model, some of which have been examined in Su and Fleisher (1999), but the methodology adopted and the conclusion made are different.

Chapter 3 Hypotheses and Methodology

This chapter describes the hypotheses and methodologies adopted in this study to examine the winner's curse model, ex ante uncertainty explanation and the signaling model.

3.1 The Winner's Curse Model

Rock (1986) proposes that high positive returns observed in IPOs cannot be earned in practice because of adverse selection. Uninformed investors are allocated greater quantities in overpriced IPOs and smaller quantities in underpriced IPOs. This is because investors who are informed about the issuing company's value select to invest in underpriced IPOs only. Underpricing is then needed to attract uninformed investors. In equilibrium, "weighting the returns by the probabilities of obtaining an allocation should leave the uninformed investor earning the riskless rate" (Rock 1986). Therefore we expect:

H_1: *After ration-adjusted, uninformed investors tend to earn the riskless rate.*

Rock's model assumes that uninformed investors invest in IPOs indiscriminately. Thus to test this proposition, we assume that uninformed investors subscribe a fixed

amount of shares for each and every IPO. And their allocation-weighted initial return is given by[10]

$$AWIR = \frac{P_1 - P_0}{P_0} * BALLOT - \frac{I_1 - I_0}{I_0} \qquad (1)$$

where

AWIR is allocation-weighted initial return measured from the application-close date to the initial-listing date

P_1 is closing price on the first day of trading

P_0 is IPO offer price

BALLOT is ballot ratio used in lottery, i.e. the allocation rate

$(I_1-I_0)/I_0$ is *A*-share composite index return from IPO date to first trading date in corresponding stock exchanges, my proxy for market return. I_1 is the corresponding stock exchange closing price of *A*-share composite index on the first trading date; I_0 is the corresponding stock exchange closing price of *A*-share composite index on the IPO date.

The first part on the right hand side of equation (1) is the allocation-weighted initial return without adjusting of the market factor. The second part is the *A*-share composite index[11] return from IPO date to first trading date. Interest cost associated with the

[10] In the fixed price offering, unsuccessful parts of application deposit are refunded around one week after the IPO subscription date. However, since the interest rate is extremely low in the Chinese market (average one-week interest rate in the study period is close to zero, 0.039%) and there are few other investment opportunities, it does not make much a difference for investors to get the deposit money back. Therefore, here I treat the application deposit frozen until the first trading date.

[11] Following other studies, I use the Shanghai A-share composite index and the Shenzhen A-share composite index as corresponding market benchmarks. They are capitalization-weighted indices using all A-shares listed on the respective stock exchanges.

application is ignored because of the extremely low interest rate. Hypothesis $\boldsymbol{H_1}$ states that *AWIR* is approximately equal to the riskless rate of interest.

Rock's (1986) winner's curse model also implies a negative correlation between initial returns and allocations to investors. Since informed investors avoid overpriced IPOs, uninformed investors receive larger allocations of shares on which they earn negative returns and smaller allocations in underpriced IPOs. Thus the joint participation by both informed and uninformed investors in underpriced IPOs makes the demand for underpriced IPOs high, thus allocation rate low. My second hypothesis to test Rock's model is to examine the relation between underpricing and allocation rate.

$\boldsymbol{H_2}$**:** *IPO initial returns are inversely correlated to allocations with investors.*

This relationship can be examined by the following simple OLS regression

$$IR = \beta_0 + \beta_1 BALLOTT + \varepsilon \tag{2}$$

where *IR* is the initial returns and *BALLOTT* is the logistic transformation of the ballot ratio[12]:

$$BALLOTT = \log(BALLOT + \alpha)/(1 - BALLOT + \alpha) \tag{3}$$

The logistic transformation is used here to accommodate the cases where *BALLOT* is practically 0 or 1. We expect β_1 in equation (2) to be negative and significant.

3.2 Ex ante uncertainty

Another key empirical implication of the winner's curse model, pointed out by Ritter (1984) and formalized in Beatty and Ritter (1986), is that underpricing should increase

[12] I The same transformation is used as Amihud *et al.*(2003). The term a=0.5/T, where T is the sample size.

in the ex ante uncertainty surrounding an issue. The underpinning is that higher uncertainty leads to proportionally more informed-investors, which deteriorates the winner's curse problem (see chapter 2). Other testable implications of winner's curse model are basically elicited from this relationship between ex ante uncertainty and underpricing. For example, Carter and Manaster (1990), Johnson and Miller (1988), James and Wier (1990) and many other researchers tested the relationship between the underwriter's reputation and initial returns as evidence of adverse selection since it is argued that more prestigious underwriters can reduce the informational asymmetry and thereby cut the underpricing cost. Another explanation is that hot issue periods are characterized by a higher level of ex ante uncertainty, necessitating higher underpricing (Ritter, 1984).

However these relationships are not unique to adverse selection model. As discussed in section 2, the signaling model and principal-agent model imply the same. Therefore I will test the ex ante uncertainty explanation separately.

Beatty and Ritter (1986) assert that the degree of underpricing is directly related to the ex ante uncertainty about the value of the IPO. Their proposition supported by Rock (1986) states that the greater the ex ante uncertainty about the value of IPO, the greater the expected underpricing. In other words, more underpricing cost is needed for firms with greater ex ante uncertainty. In the Chinese market, there are large ex ante uncertainties about IPO values (see chapter 2). Therefore ex ante uncertainty might be one of the main reasons for the high IPO underpricing observed from the Chinese market.

Researchers have been using variance of the aftermarket returns of IPOs (Ritter 1984, 1987; Clarkson and Merkley (1994)), age of the firm at the time of offering (Ritter

1984, 1991; Megginson and Weiss 1991), offer size (Beatty and Ritter 1986; McGuinness 1992) and underwriter's reputation (Carter and Manaster, 1990; Johnson and Miller, 1988; James and Wier, 1990) as proxies for measuring ex ante uncertainty of the IPOs. It is easy to understand that the higher the standard deviation of aftermarket returns the higher the ex ante uncertainty of the IPO firms. Large and old companies should have less ex ante risk than small and young ones because there is more information about them and because they are likely to be more closely monitored by the government and regulatory authorities. I am not going to use underwriter's reputation as a proxy in this study because the Chinese *A*-share issues are underwritten by domestic state-owned security companies and there are no prestigious financial institutions with international reputations involved. Furthermore Wu (2001) finds that underwriter's reputation has no significant effect on the degree of underpricing in the Chinese new issue's market. The rest of three proxies for ex ante uncertainties predict that the larger the variance of the aftermarket returns of IPOs, the younger the age of the issuing firms and the smaller the offering size, the higher the uncertainty about the value of IPO firms and therefore the more underpriced of corresponding IPOs. Thus we would expect:

H_3: *The standard deviation of aftermarket returns of IPOs is positively related to IPO underpricing.*

H_4: *The offer size of the firm is inversely related to IPO underpricing*.

H_5: *The age of the firm is inversely related to IPO underpricing*.

I use a multiple linear regression model to examine the explanatory power of ex ante uncertainty and control for other well-known determinants of IPO underpricing. The dependent variable is the market adjusted initial return. The proxies for ex ante

uncertainty are SD, AGE and IPOSZ, where SD is standard deviation of returns over days from 1 to 100 after IPO, AGE is the age of a firm in years from the establishment date to the date of IPO, and IPOSZ is the number of shares offered at IPO times the IPO offer price.

Other variables that might affect the level of ex ante uncertainty are also controlled for. The first one is the market return before IPO. Ritter (1984) asserts that hot issue period is characterized by a higher level of ex ante uncertainty, which necessitates higher underpricing. There has been overwhelming evidence that underpricing is higher in buoyant stock markets: Davis and Yeomans (1976) (UK), Reilly (1977) (USA), McGuiness (1992) (Hong Kong) and Rydqvist (1990) (Sweden) all show that initial returns tend to be higher following periods of high returns on the market index. To test if Chinese IPOs are more heavily underpriced when the market is performing well, I use BFMARTN, percentage change in the *A*-share composite index 3 months prior to the issue, as one of the explanatory variables. Another control variable is the issuers' fractional ownership. In an emerging market with high information asymmetry, the domestic investors interpret a high percentage of equity retention by the state as government confidence and a business guaranty. That is high equity retention by the state lowers ex ante uncertainty (Mok and Hui 1998). The time gap elapsed between the IPO date and first trading date can also affect level of ex ante uncertainty. Chowdry and Sherman (1996) demonstrate that an increasing lag between the fixing of the offer price and the beginning of trading results in bigger ex ante uncertainty and more IPO underpricing. Mok and Hui (1998) and Su and Fleisher (1999) reported a very high time gap between offering and listing time in the Chinese market. Therefore I add time lag from IPO date to first trading date as one of the

independent variables. Other control variables include year dummies, industry dummies and the stock exchange dummy.

$$IR = \beta_0 + \beta_1 SD + \beta_2 \ln AGE + \beta_3 \ln IPOSZ + \beta_4 BFMARTN + \beta_5 OWNSHP + \beta_6 LAG + \beta_7 Y96 + \beta_8 Y97 + \beta_9 IN2 + \beta_{10} IN3 + \beta_{11} IN4 + \beta_{12} IN6 + \beta_{13} STKCDSH + \varepsilon \quad (4)$$

If $\boldsymbol{H_3}$, $\boldsymbol{H_4}$ and $\boldsymbol{H_5}$ hold, we expect β_1 to be positive, and β_2 and β_3 to be negative. If the ex ante uncertainty hypothesis stands, we also expect positive β_4 and β_6 and negative β_5.

For convenience of reference, I list all variables used below:

RAWIR $(P_1-P_0)/P_0$

IR market adjusted initial return equals to RAWIR minus *A*-share index return from IPO date to first trading date, $(P_1-P_0)/P_0-(I_1-I_0)/I_0$

AGE age of a firm in years from the establishment date to the date of IPO

IPOSZ number of shares offered at IPO times IPO offer price *SD* Standard deviation of aftermarket stock returns over days from 1 to 100 after IPO *OWNSHP* the proportion of shares owned by the government, legal entities and employees after IPOs

LAG days elapsed between IPO date and the first trading date

YRD year dummies: Y96 equals to 1 for IPOs made in 1996 (including one IPO in November and one in December 1995), Y97 equals to 1 for IPOs made in 1997, Y98 equals to 1 for IPOs made in 1998.

IND industry dummies: IN2 utilities, IN3 properties, IN4 conglomerates, IN5 industry, IN6 commerce

EXD exchange dummies, STKCDSH is a dummy for IPOs listed on Shanghai Securities Exchange and STKCDSZ are IPOs listed on Shenzhen Stock Exchange.

BFMARTN percentage change in the A share composite index 3 months prior to the issue.

The following are variables that are going to be used in latter part of this study. I list them all here for convenience of reference.

AFTRTN Abnormal return over the period from trading day 1 to trading day 400 after the IPO date. The abnormal return equals to $[(P_{400}-P_1)/P_1]-[(I_{400}-I_1)/I_1)]$ where P_{400} is the 400^{th} day closing price of the stock and I_{400} is the 400^{th} day closing price of the corresponding exchange A-share composite index.

SEOSZ number of shares offered at first SEO times SEO price

SEOSZ/MKT SEO size as a fraction of market value of equity one day before the SEO announcement

TIMESEO number of days elapsed between the IPO and SEO first trading date

REACT Excess return around the date when the firm announces its SEO. The excess return is estimated over the event days -1 through +4, where day 0 is the SEO announcement date, and equals to $[(P_4-P_{-1})/P_{-1}]-[(I_4-I_{-1})/I_{-1}]$, where P_4 is the 4^{th} day closing price of the stock and I_4 is the 4^{th} day closing price of the corresponding exchange *A*-share composite index after the SEO announcement (the SEO announcement date is taken as the publishing date of the SEO prospectus).

V	Firm's intrinsic value equals to 400 trading days aftermarket abnormal return (same as AFTRTN).
V1	firm's market capitalization on the first trading day, equals to the first day closing price times the number of shares offered at IPO
SEOPRC/TRDPRC	SEO price over the closing price one day before the SEO announcement date
NK	Firm's total net asset after the issue
Y2ROA	firm's return on assets two years after IPO

3.3 The signaling model

Group 1 - Correlations among IPO underpricing and issuer's intrinsic value, fractional ownership and project variance

Leland and Pyle (1977) developed one of the first IPO valuation-signaling models. They modeled IPO firm current value as a positive function of the proportionate share ownership of the entrepreneurs who bring the company to listing. The intuition behind this model is that entrepreneurs who retain a large fraction of shares only do so if they are very confident about the firm's prospects. Investors recognize this commitment by the entrepreneur and place a higher valuation on the IPO.

H_6: *Positive relationship between the issuer's fractional ownership and firm value*

Downes and Heinkel (1982) design an empirical test of Leland and Pyle's theoretical signaling model in the form of the following regression:

$$V1 = \beta_0 + \beta_1 IPOSZ + \beta_2 \hat{\alpha} + \varepsilon \quad (5)$$

Where V1 is the firm's market capitalization on the first trading date, equals to the first day closing price times the number of shares outstanding, α is the issuer's proportional ownership and $\hat{\alpha}$ = α +ln(1- α), the Leland and Pyle's signal of a firm's future cash flow[13], as a function of α. Based on this construction, β_2 is expected to have a negative sign. ε is a disturbance term. Downes and Heinkel's regression model assumed constant risk across all firms. To account for different risks across firms, I incorporate a risk term in the above equation, using the ex post variability in the stock market returns as a proxy for ex ante risk:

$$V1 = \beta_0 + \beta_1 IPOSZ + \beta_2 \hat{\alpha} + \beta_3 SD + \varepsilon \quad (6)$$

where $\hat{\alpha}$ = α +ln(1- α) and α equals to OWNSHP. So if Leland and Pyle's ownership signaling model stands, we expect a negative β_2. Higher risk should be compensated with more returns. Grinblatt and Hwang (1989)'s signaling model also implies that, keeping the issuer's fractional holding constant, the value of the firm is positively related to the variance of its cash flows. Therefore we expect β_3 to be positive and significant.

After Leland and Pyle's study using issuer's ownership as a signal of firm quality, Allen and Faulhaber (1989) and Welch (1989) extend the signaling model by

[13] Leland and Pyle show that in the context of the CAPM, the value of the firm will be given by:
$V(\alpha) = (-bZ/(1+r))[\alpha + \log(1-\alpha)] + K$
where
r =the riskless interest rate;
b =the risk aversion parameter in the entrepreneur's mean-variance utility function;
K =the amount of capital raised; and
$Z = \dfrac{\sigma_x^2 \sigma_m^2 - [\mathrm{cov}(\tilde{x}, \tilde{m})]^2}{\sigma_m^2}$
where $\tilde{x}$ and $\tilde{m}$ are the returns on the firm and the market, respectively.

introducing the notion that IPO underpricing is another signal of firm quality. In the same year, Grinblatt and Hwang construct a model of bivariate signaling which is closest to Leland and Pyle's model. Leland and Pyle analyze only one signal; only one parameter can be unknown, implying that the variance of the cash flows of the firm's projects must be observable. In Grinblatt and Hwang's model, the variance as well as the mean of the project's cash flows is unknown, so that a second signal, the level of underpricing, is needed to convey the firm's value to the market.[14] In the model's separating equilibrium, a firm's intrinsic value is positively related to the degree its new issue is underpriced. There are eight empirical implications of Grinblatt and Hwang's model, the following three are unique (Among the remained five implications, four are consistent with Leland and Pyle's model and one is consistent with Rock's model):

H_7: *The degree of underpricing is positively related to the issuer's fractional ownership given the variance of the firm's cash flow*

H_8: *Firm value is positively related to the degree of underpricing given the issuer's fractional ownership*

H_9: *Firm value and the degree of underpricing are positively related given the variance of the firm's cash flows*

H_7 can be tested with the following simple OLS regression:

$$IR = \beta_0 + \beta_1 OWNSHP + \beta_2 SD + \varepsilon \qquad (7)$$

H_8 and H_9 can be examined as follows

$$IR = \beta_0 + \beta_1 V + \beta_2 OWNSHP + \beta_3 SD + \varepsilon \qquad (8)$$

[14] Grinblatt and Hwang's model explained IPO underpricing, while Leland and Pyle's did not.

where V is a proxy for firm's intrinsic value-the 400 trading days aftermarket abnormal return (this is more than one and half years of aftermarket return; 400 days are chosen because of the data availability). We expect β_1 to be positive if $\boldsymbol{H_8}$ and $\boldsymbol{H_9}$ hold. However there might be an error in variable problem in equation (8). In Grinblatt and Hwang (1989)'s model, if the expected value and the variance of future cash flow for a risk-averse firms is unknown to investors, then there exists an equilibrium signaling schedule relating two signals, fractional holding and IPO underpricing corresponding to the probability of the firm's intrinsic value to be revealed. So IR and OWNSHP are determined endogenously. Moreover, since both IR and V include the first day trading price, they might be spuriously negatively correlated. To check these possible spurious correlation and simultaneous bias problems, I use Housman test to examine the exogeneity of the two variables, V and OWNSHP. Exogenous variables AGE, Y2ROA, NK, year dummies, industry dummies and the stock exchange dummies are used as instrumental variables.

Different proxies have been used for IPO firm's intrinsic value in previous studies such as initial market valuation[15] of the firm's quality (Firth and Liau-Tan 1997; McGuiness 1992) and two year aftermarket excess returns on equity (Michaely and Shaw 1994). I choose Michaely and Shaw's method because, firstly, initial market valuation does not necessarily reflect firm's true value, it sometimes can be a result of over reaction or fads. Su and Fleisher (1999) use the market capitalization in 1996 as a proxy of firm's intrinsic value for his entire sample IPOs from 1987 to 1995. I do not regard this as a suitable measure since different IPOs have different aftermarket

[15] Initial market valuation of the firm is estimated using the price at the end of the first day of trading in Firth and Liau-Tan (1997) and using the price at the close of the tenth day of trading in McGuiness (1992).

information revelation time and there is likely to be a bias for firms that issue IPOs later.

Group 2 – Linkages between IPOs and Seasoned Equity Offerings

The central result of the theoretical models of Allen and Faulhaber (1989), Grinblatt and Hwang (1989) and Welch (1989) is that high quality firms underprice IPOs with the expectation that the loss can be recouped through subsequent equity offerings after investors have had the opportunity to recognize the firm's true potential. Low quality firms cannot mimic high-quality firms as they are denied the opportunity to sell seasoned issues at attractive prices and capture the potential benefits of IPO underpricing. In other words, good firms underprice to "leave a good taste in investors' mouths" and they will be rewarded at the time of the seasoned issue by a higher price for the shares. Therefore, the signaling model leads to the empirical predictions:

***H_{10}**: Firms with more underpriced IPOs are more likely to issue seasoned equity than firms with less underpriced IPOs*

A direct implication of the signaling model is that, in their eagerness to capitalize on the favorable news, high-quality firms will return to the capital market as soon as the opportunity comes, and to maximize the benefit. Namely high-quality firms are more likely to reissue. Another reason is that the costs of raising fund are higher for firms underprice more, so they are more likely to come to the seasoned equity market to recoup their lost. This also implies that:

***H_{11}**: Firms with more underpriced IPOs are likely to issue seasoned equity more promptly than firms with less underpriced IPOs*

Another intuition behind is that it is more costly for high quality firms to defer their investments in new projects than for firms of low quality (Jegadeesh et al, 1993).

The signaling model implies empirically a positive association between underpricing and the success of the SEO. The success of SEO can be measured in terms of the SEO size relative to its IPO size and the market reaction to the seasoned issue. This leads to our H_{12} and H_{13}.

H_{12}: *Firms with more underpriced IPOs are likely to issue larger amount of seasoned equity than firms with less underpriced IPOs*

H_{13}: *Firms with more underpriced IPOs are likely to experience a less unfavorable price reaction to SEO announcement than firms with less underpriced IPOs*

H_{13} follows the notion that firms with higher IPO underpricing are more likely to return with seasoned equity issue and hence investors are more prepared for or less surprised by their SEOs. In other words, SEOs from firms with more underpriced IPOs are better received by investors because of their superior quality.

There is, however, an alternative explanation for the existence of the above relations between IPO underpricing and SEO activity. In fact market feedback hypotheses posits that the market is better informed than the issuer and hence a high return on the IPO date or a very good aftermarket performance of stocks implies that the issuer has underestimated the marginal return to the project. The issuer uses this information and increases the scale of the project by raising additional capital through seasoned offerings. To explore whether the relations between IPO underpricing and SEO activity can be explained by market feedback hypotheses, I examine whether the returns in 400 trading day after the IPOs are related to subsequent offering. I choose a

400 trading day post-IPO window to measure the aftermarket returns because the cross-sectional standard deviation of the aftermarket returns in the 400 day window is about the same as the cross-sectional standard deviation of the IPO date returns, which suggests that the same amount of information is revealed to the market during these two periods. This follows the logic in Jegadeesh (1993). Whereas Su and Fleisher (1999) use only the 10-day after-market returns to test the market feedback hypothesis. There is comparatively too little of information revealed in such a short time than that revealed on the initial trading date. Therefore it is not appropriate to compare the effect of the two variables on SEO activities even after adjusting for standard deviation.

Following Jegadeesh et al. (1993), I test the $\boldsymbol{H_{10}}$ using a logit model.

$$\ln\left[P^{seo}/(1-p^{seo})\right] = \beta_0 + \beta_1 IR + \beta_2 AFTRTN + \beta_3 \ln IPOSZ + \beta_4 Y96 + \beta_5 Y97 + \beta_6 IN2 + \beta_7 IN3 + \beta_8 IN4 + \beta_9 IN6 + \beta_{10} STKCDSH + \varepsilon \quad (9)$$

Where P^{seo} is the probability that a firm issues seasoned equity after the initial offering. The first two independent variables are market adjusted initial return (underpricing) and the aftermarket abnormal eturn over the period from trading day 1 to trading day 400 after the IPO date. The after-market abnormal return equals to market-adjusted return over the same period. Since firms with a small IPO size are more likely to come to seasoned equity offering, I include the natural logarithm of the IPO size as an additional explanatory variable. Finally, I also control for potential differences in SEO activity across years, industries and exchanges. We expect a positive β_1 if $\boldsymbol{H_{10}}$ is true and a positive β_2 if market feedback hypothesis is true.

To examine the relationship between the time elapsed between IPO and SEO, *TIMESEO*, and IPO underpricing, I use a tobit model with right censoring. For firms with no SEOs over the years from 1996 through 2001, I assume that the time it takes for their re-issuance is infinity. For firms that issue their first SEOs during that period, the maximum time elapsed between IPO and SEO in our sample is 1394 days. Therefore, I take ln(1400) as the right censoring value. The explanatory variables are the same as those in the previous logit model. Su and Fleisher also use a Tobit model to test the same hypothesis. But for IPOs with no seasoned equity offerings, they take *TIMESEO* value as zero and use a left censoring test, which is inaccurate.

$$\ln TIMESEO = \begin{cases} \beta_0 + \beta_1 IR + \beta_2 AFTRTN + \beta_3 \ln IPOSZ + \beta_4 Y96 + \beta_5 Y97 + \beta_6 IN2 + \beta_7 IN3 + \\ \beta_8 IN4 + \beta_9 IN6 + \beta_{10} STKCDSH + \varepsilon & if \quad RHS < \ln 1400 \\ \infty & otherwise \end{cases} \quad (10)$$

We expect a negative β_1 if $\boldsymbol{H_{11}}$ is true and a negative β_2 if market feedback hypothesis is true.

To test $\boldsymbol{H_{12}}$ we use a Tobit model similar to Jegadeesh et al. (1993). The Tobit model specifies the relation between the relative size of seasoned offering and the explanatory variables as follows:

$$SEOSZ / IPOSZ = \begin{cases} \beta_0 + \beta_1 IR + \beta_2 AFTRTN + \beta_3 \ln IPOSZ + \beta_4 Y96 + \beta_5 Y97 + \beta_6 IN2 + \beta_7 IN3 + \\ \beta_8 IN4 + \beta_9 IN6 + \beta_{10} STKCDSH + \varepsilon & if \quad RHS > 0 \\ 0 & otherwise \end{cases} \quad (11)$$

where SEOSZ/IPOSZ is the relative size of Seasoned Equity Offerings. The independent variables are the same as those in the logit model. Similarly, we expect a positive β_1 if $\boldsymbol{H_{12}}$ is true and a positive β_2 if the market feedback hypothesis holds.

To examine the excess return around the date when the firm announces its SEO, I estimate the excess return over the event days -1 through +4, whereday 0 is the SEO announcement date. The excess return, REACT, equals to $[(P_4-P_{-1})/P_{-1}]-[(I_4-I_{-1})/I_{-1}]$, where P_4 is the 4^{th} day closing price of the stock and I_4 is the 4^{th} day closing price of the corresponding exchange *A*-share composite index after the SEO announcement (the SEO announcement date is taken as the publishing date of the SEO prospectus). P_{-1} and I_{-1} are the stock price and index price 1 day before the SEO announcement.

Moreover I include a variable *TIMESEO*, which measures the number of days between the IPO date and the SEO date. The longer the time between these events, the greater the volume of public information released about the firm, thus reducing the uncertainty about the firm value. Additional independent variables are *SEOSZ/MKT*, which is the SEO size over the stock market value 1 day before the SEO announcement and *SEOPRC/TRDPRC*, which is the SEO price over the closing price 1 day before the SEO announcement. These variables are included to control for possible differences in the extent to which the market is surprised by the SEO announcements that are not related to the initial returns of their IPOs or their after-market returns. For firms with SEOs, we do the following regression to examine $\boldsymbol{H_{13}}$:

$$\begin{aligned} REACT &= \beta_0 + \beta_1 IR + \beta_2 AFTRTN + \beta_3 \ln IPOSZ + \beta_4 Y96 + \beta_5 Y97 + \beta_6 IN2 + \beta_7 IN3 \\ &\quad + \beta_8 IN4 + \beta_9 IN6 + \beta_{10} STKCDSH + \beta_{11} \ln TIMESEO + \beta_{12} \ln SEOSZ \\ &\quad + \beta_{13} SEOSZ/MKT + \beta_{14} SEOPRC/TRDPRC + \varepsilon \end{aligned} \quad (12)$$

Similarly, we expect a positive β_1 if $\boldsymbol{H_{13}}$ is true and a positive β_2 if the market feedback hypothesis is true.

Chapter 4 Data and Empirical Results

4.1 Data and underpricing

To pursue the objectives of this study, I examine all online fixed price (Shang Wang Ding Jia) and firm commitment *A*-Share IPOs over the period November 1995 - December 1998. Financial institutions and close-end funds are excluded because previous work, reviewed in Smith (1986) indicates that regulation of these entities affects securities issuance phenomena. Online fixed price offering is the most commonly used offering method in Chinese *A*-share IPOs. The study of the online fixed price IPOs can represent the general IPO market in China. I exclude the IPOs after 1999 to obtain sufficient after-market data for testing the signaling model. To do this, I need at least 3 years' time for the listed firms to issue their first seasoned equity offerings. The sample period ends in 1998, which also helps control for government intervention in the pricing of IPOs since after 1998 there was a policy change in the ceiling for the PE ratio (Before January 1999, a ceiling of 15 was imposed; after that, the restriction was loosened and the PE ratio used in IPO pricing rises dramatically. Tian (2003) finds that after the deregulation, initial returns decrease by 133.5 percent in China.) The data comes from several sources including the trading database from GTA (Guo Tai An Information Technology Co.), IPO database from Haitong Securities and the panorama network website, www.p5w.net. Finally a sample of 343 IPOs is collected, representing a broad spectrum of industries such as utilities, properties, conglomerates, industry and commerce. Descriptive statistics are reported in panel A of table 4.1. The mean and median offering sizes of the IPOs (i.e., gross

proceeds), are RMB 304 million and RMB 220 million respectively. The average proportion of shares retained by the state, legal entities and employees in sample IPOs is 71.04%, indicating that the majority of shareholding of equities are non-negotiable government shares and legal entities shares. The average age of IPO firms is 3 years old. The mean of PE ratio and offering price are 14.85 and 6.19 respectively.

Table 4.1Descriptive statistics on 343 IPOs in the 1996-1998 period and 215 SEOs in the period 1996-2001

Variable	No. Obs.	Mean	Median	Maximum	Minimum	Std. dev.	Skewness
Panel A IPO characteristics							
IPOSZ (million RMB)	343	304.00	220.50	2625.00	33.00	310.00	3.60
OWNSHP	343	0.7104	0.7353	0.8649	0.3670	0.0721	-1.2751
AGE (years)	343	3.06	2.03	40.99	0.10	3.27	6.08
PE	343	14.85	14.57	32.52	8.80	2.51	0.76
LAG (days)	343	32.43	21.00	377.00	9.00	35.09	6.02
NK (million RMB)	343	751.44	466.27	7363.60	103.97	950.01	3.97
P_0	343	6.19	5.99	15.70	2.45	1.83	1.38
P_1	343	13.71	12.74	53.57	4.41	6.01	1.90
BFMARRTN	343	0.1583	0.1076	0.8649	-0.2859	0.2407	0.6655
AFTRTN	343	0.1482	-0.0210	3.9045	-3.0145	0.7575	1.3241
Panel B SEO characteristics							
SEOSZ (million RMB)	215	248.27	188.10	1395.00	2.08	206.07	2.49
SEOPRC	215	8.79	8.00	26.00	3.30	3.50	1.60
TIMESEO (days)	215	805	805	1394	441	219.44	0.55
REACT	215	-0.0109	-0.0144	0.2672	-0.1308	0.0472	1.2076

215 out of the 343 IPOs issue their first SEOs in the period 1996 to 2001. In other words, over 60% of the sample IPOs issues SEOs. All the 215 SEOs included in our study are rights offers (SEOs to the existing shareholders). Public seasoned offering (SEOs to the general public investors) are rarely seen in China because public seasoned offerings are not permitted until 1997. Even after the restriction was lifted, very few firms use public offerings in their re-issuances. Some characteristics of the

SEO data are reported in panel B of table 4.1. The average SEO price is RMB 8.79 and the average SEO size is RMB 248.27 million. The mean and minimum time it takes from IPO to SEO is 805 days and 441 days, respectively.

Table 4.2 presents the distribution of new and seasoned equity offerings through time. Fixed priced new issues from 1996 to 1998 distributed quite evenly and each year accounts for around 30% of all sample IPOs. Most SEOs occur during the time from 1998 to 2000. 85% of the SEOs in my sample are from the year 1998 to 2000.

Table 4.2 Distribution of 343 fixed pricing IPOs and 215 first seasoned equity offerings (SEOs) by offering year, 1996-2001

	Initial Public Offering		**Seasoned Offerings**	
Year	**Number**	**Percentage (%)**	**Number**	**Percentage (%)**
1996	121	35.28	0	0.00
1997	125	36.44	19	8.84
1998	97	28.28	66	30.70
1999			52	24.19
2000			65	30.23
2001			13	6.05
Total	343	100.00	215	100.00

To measure the level of IPO underpricing, I use the market adjusted initial return i.e. the raw initial return after taking into account of the overall market effect.

The raw initial return (RAWIR) is calculated as:

$$RAWIR = (P_1 - P_0) / P_0$$

P_0 is the offer price and P_1 is the first day closing price.

Market adjusted initial return equals to RAWIR minus *A*-share composite index return from the IPO date to its first trading date.

$$IR = RAWIR - (I_1 - I_0) / I_0$$

where I_1 is the closing price of the SHSE *A*-share composite index or SZSE *A*-share composite index on the first trading day of the new issue, and I_0 is the closing price of the SHSE *A*-share composite index or SZSE *A*-share composite index on the IPO date. To examine a longer-term IPO after-market performance, I calculate initial returns over 10 and 100 trading days after the IPO as

$$IR10 = (P_{10} - P_0)/P_0 - (I_{10} - I_0)/I_0$$

and

$$IR100 = (P_{100} - P_0)/P_0 - (I_{100} - I_0)/I_0$$

Table 4.3 Initial returns in IPOs, with adjustment for allocation

	Variable	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness
Initial return (underpricing)							
1	***IR***	1.2359 (27.00)	1.1123	8.2050	-0.1211	0.8479	2.4129
2	***IR10***	1.1927 (26.38)	1.0619	5.6548	-0.1886	0.8372	1.5264
3	***IR100***	1.2379 (25.07)	1.0192	5.4331	-0.8410	0.9145	1.1342
Allocation-weighted initial return							
4	***AWIR***	-0.0033 (-0.63)	-0.0050	0.3652	-0.3621	0.0955	-0.1360

The number in parenthesis is the *t*-statistics test that the mean is different from zero.

Some summary statistics for the initial excess returns are presented in table 4.3 and the distribution of *IR* is depicted in figure 1. The average *IR* is positive and significant: the mean is 123.59% with $t = 27.00$. Only 7 out of 343 IPOs have negative initial returns. Nearly 98% of the IPOs have positive initial returns. The average 10-day and 100-day initial excess returns, *IR*10 and *IR*100, are 119.27% and 123.79%, respectively. This is much lower than the Chinese IPO underpricing level in early 1990s reported in previous studies, showing that the Chinese new issue market has indeed improved its efficiency. *IR*10 is slightly lower than *IR*, and *IR*100 is slightly higher than *IR*.

Notably, the mean initial return from day +1 to day +100 is not significantly different from zero (mean = –1.72%, t = –0.93). If the price of a new issue at the opening of trade represents an overreaction or speculative bubble rather than the true economic or fundamental price, we should witness a significant decline in the stock return in the after-market. However, we do not see a statistical difference between *IR* and *IR*100, which suggests that there is no momentum effect in pricing. The correlation between *IR* and the subsequent initial returns from day +1 to day +100 is 0.114, indicating that the price of the IPO stocks adjusts efficiently after the IPO. All 3 initial return distributions are positively skewed, reflecting the very high returns obtained in a few cases (see figure 4.1).

Figure 4.1 The distribution of the initial excess return in IPOs

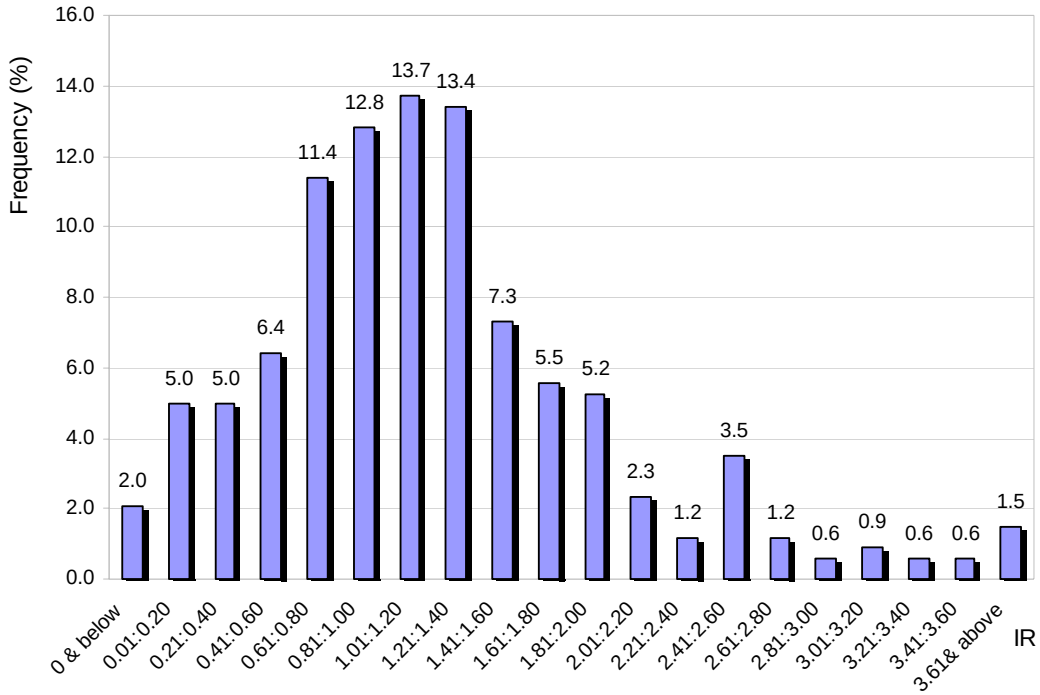


Table 4.4 presents the summary statistics of the initial returns and the PE ratios used in IPO pricing by year and by stock exchange. There are only 2 observations in 1995 and I include these into the data for 1996. The average initial returns in 1996, 1997 and 1998 are 95.87%, 144.96% and 130.57%, respectively. The significant difference in underpricing across years is mainly caused by the changes in the IPO pricing policy over time. As discussed before, the offer price in the Chinese fixed price offering is determined by the multiplication of PE ratio of the same industry and the issuing firm's after-tax profit per share. The supervisory authorities often impose a ceiling to the PE ratio used and the ceiling level changes over time. Table 4.4 shows that the PE ratios used in 1996 are significantly higher than that in 1997 and 1998. I will not analyze in detail why the initial return in 1996 is lower than that of 1997 and 1998 or why the IPOs in 1997 are more underpriced than IPOs in 1998 since the policy changes are complicated. There is not much difference in the initial returns and PE ratios across the two stock exchanges.

Table 4.4 Statistics of initial returns and PE ratios by years and by stock exchanges

	Years	Mean	Median	Maximum	Minimum	Skewness
1996 (121)						
	IR	0.96	0.95	3.37	-0.12	0.90
	PE	15.34	14.90	32.52	9.70	0.26
1997 (125)						
	IR	1.45	1.29	4.64	0.01	1.46
	PE	14.67	14.90	18.00	10.00	-0.16
1998 (97)						
	IR	1.31	1.13	8.20	-0.05	3.25
	PE	14.48	14.50	18.00	8.80	0.20
Shanghai (170)						
	IR	1.20	1.11	4.31	-0.12	1.05
	PE	14.86	14.57	32.52	8.80	3.13
Shenzhen (173)						
	IR	1.27	1.13	8.20	-0.11	2.86
	PE	14.84	14.57	27.96	11.35	-0.59

The figure in the parenthesis is the number of sample IPOs in that year or at that stock exchange.

4.2 Allocation and Adverse selection

The pro rata allocation rate in China is the ballot ratio used in the lottery and equals to the ratio of the number of shares publicly offered in the IPO to the number of shares subscribed by investors. There is no under-subscription in the sample. *BALLOT* denotes the ballot ratio (allocation rate). Some summary statistics of *BALLOT* are presented in table 4.5, and the pattern of its distribution is depicted in figure 4.2.

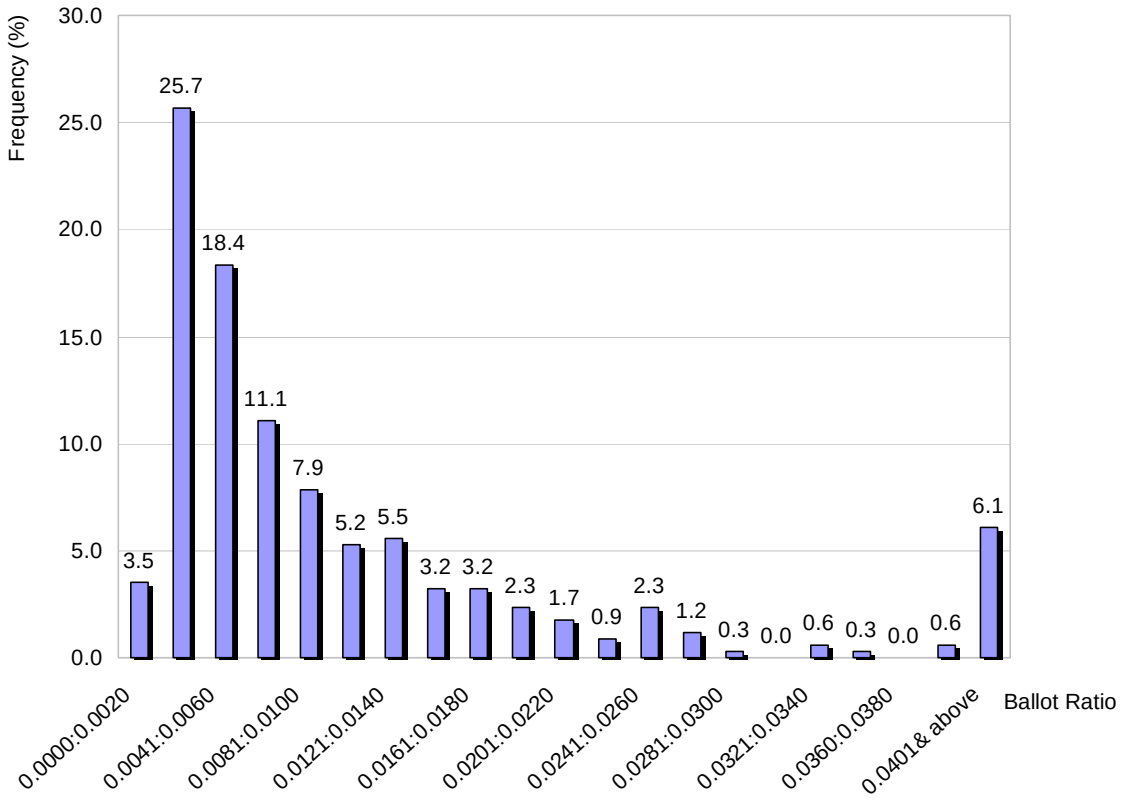
Table 4.5 Statistics of allocations in sample IPOs

	Mean	Median	Maximum	Minimum	Obs.
BALLOT	0.0218	0.0065	0.9540	0.0013	343
Ballot classified by initial return					
For IR<0; Ballot	0.3432	0.0851	0.954	0.0057	7
For IR>0; Ballot	0.0151	0.0065	0.7315	0.0013	336

The ballot ratio in most IPOs is extremely small due to the overwhelming oversubscription. The overwhelming oversubscription is mainly caused by surplus demand for the limited supply of negotiable shares. Moreover, the vast majority of the primary market investors are relatively unsophisticated private individual investors. The characteristics of Chinese individual investors and the weakness in information disclosure result in a very big proportion of uninformed investors in the Chinese market. The distribution shows that the allocation rate in most IPOs (95%) is below 5% and there are only a few cases with ballot ratio greater than that. The mean for *BALLOT* in our sample is 2.18% and the median is much lower, 0.65%. The average allocation rate for overpriced IPOs is 34%, which is much higher than that of the underpriced IPOs (1.51%). This is consistent with the winner's curse theory that the uninformed investors have a higher probability of obtaining overpriced IPOs.

However, this is weak evidence of the presence of winner's curse problem since we have only 7 overpriced IPOs.

Figure 4.2 The distribution of allocations to investors in IPOs



If $\boldsymbol{H_1}$ is true, the allocation-weighted initial returns minus the riskless rate should be approximately zero. The statistics for *AWIR* are presented in table 4.2. The mean of *AWIR* is negative (–0.33%), and is not statistically different from zero (t = –0.63). This suggests that, despite the seemingly high initial returns, uninformed IPO investors essentially break even.

The OLS regression result for equation (2) is as follows:[16]

$$IR = -0.67 \quad - \quad 0.41 BALLOTT$$
$$(-2.74) \quad -(7.94) \qquad R^2 = 0.1535$$

The estimated coefficient for *BALLOTT* is −0.41, with $t = -7.94$. The strong inverse relationship between initial returns and allocations to investors is again consistent with Rock's hypothesis of adverse selection.

The above two empirical results confirm the major empirical implications of Rock's theory. I conclude that individual investors in China face the winner's curse problem. However, without data on application sizes and other details, it is not clear who the informed investors in the Chinese IPO market are.

4.3 Ex ante uncertainty

Model 1 of table 4.6 presents the regression results for equation (4). Consistent with $\boldsymbol{H_3}$, the coefficient for the standard deviation of the after-market returns is positive and strongly significant. The coefficients for ln*AGE* and ln*IPOSZ* are both negative and significant, which supports the ex ante uncertainty hypotheses $\boldsymbol{H_4}$ and $\boldsymbol{H_5}$, namely, the age and offer size of the issuing firm are inversely related to IPO underpricing in the Chinese IPO market.

The coefficient of *BFMARTN* is positive and significant at the 5% level, which means that the IPOs are more underpriced in hot market. This is consistent with previous studies (Davis and Yeomans, 1976 (UK), Reilly, 1977 (USA), and McGuiness, 1992 (Hong Kong)). The coefficient of *OWNSHP* is negative and significant, consistent

[16]To control for other relevant independent variables, another regression has been done (see appendix C). As shown in the table, the conclusion is of no big difference from equation (2). Therefore only regression result of equation (2) is reported here.

with Mok and Hui (1998). This shows that Chinese investors interpret high state and legal entity retention as government support and business guaranty. That is, high equity retention lowers the ex ante uncertainty about firm value, thereby lowers the required level of underpricing. The time lag between the IPO date and the first trading date is insignificant in explaining IPO underpricing in the regression. Different from Mok and Hui (1998) and Su and Fleisher (1999)'s sample, the time lag after 1996 has been dramatically shortened, which removes previous uncertain factors caused by the extreme long time lag.[17]

Table 4.6 OLS regression Analysis Investigating Ex Ante Uncertainty and other Significant Explanatory Variables of IPO Underpricing

Dependent Variable:	**IR**	**Model 1**			**Model 2**		
Explanatory Variables:		Coeff.	t stat.		Coeff.	t stat.	
	Constant	0.8331	2.64	***	0.7767	2.51	**
	SD	9.9021	78.61	***	9.9022	79.57	***
	LNAGE	-0.0312	-3.23	***	-0.0304	-3.20	***
	LNIPOSZ	-0.034	-2.23	**	-0.0315	-2.10	**
	BFMARRTN	0.0985	2.45	**	0.1003	2.50	**
	OWNSHP	-0.2875	-2.44	**	-0.2775	-2.36	**
	LAG	0.0003	0.9		0.0002	0.74	
	Y96	-0.1937	-6.56	***	-0.1968	-6.69	***
	Y97	-0.0091	-0.39		-0.0109	-0.48	
	IN2	-0.0031	-0.09				
	IN3	0.0029	0.03				
	IN4	0.0109	0.47				
	IN6	-0.0546	-1.71				
	STKCDSH	0.0517	2.93	***	0.0531	3.04	***
Adjusted R^2			0.9671			0.9671	

** Significant *t* statistics at the 5 percent level
*** Significant t statistics at the 1 percent level

[17] The average lag time in our sample is only 32 days, which is much shorter than the average of 260 days reported in Su and Fleisher's (1999) study. The much shorter lag time from the IPO date to the first listing date in our sample shows that the online fixed pricing offering method is more efficient than previously used offering methods.

The positive and significant coefficient for the dummy variable *Y*96 shows that the IPOs made in 1996 are less underpriced than the IPOs in 1998. This might be affected by the changes of the PE ratio used in IPO pricing. There is no statistical difference in underpricing across industries. The IPO underpricing in SHSE is significantly higher than that in SZSE. As we have seen in table 4.4, there is not much difference in the PE ratio used in IPO pricing across the two exchanges. Thus, this cannot be caused by the difference in the PEs. One explanation is that many firms at SZSE are joint ventures, while those listed at SHSE are mostly SOEs. There are relatively more disclosure and less uncertainty in joint venture firms. That is why IPOs listed on SZSE are less underpriced. The model explains 96.7% of the variability in initial returns of the sample of *A*-share IPOs, which shows the strong explanatory power of ex ante uncertainty. This supports my hypothesis that the high ex ante uncertainty in IPO value is the main reason for the high level of IPO underpricing observed in the Chinese market. Model 2 in table 4.6 presents a regression excluding 4 insignificant industry dummy variables. The conclusion is the same as those from model 1.

4.4 The signaling model

Group 1- Correlations among IPO underpricing and issuer's intrinsic value, fractional ownership and project variance

Table 4.7 presents my regression result for equation (6). Control for risks and IPOSZ, the slope coefficient estimate (*t*-statistics) of $\hat{\alpha}$ is 79.85 (1.06). Not only it is not statistically significant but also the sign is opposite to Leland and Pyle's prediction.

This indicates that the ownership signaling model does not stand in the Chinese *A*-share market. As expected, the coefficient for SD is positive and significant.

Table 4.7 OLS regression to test Leland and Pyle's theoretical signaling model

Dependent Variable:	***V1***			
Explanatory Variables:		**Coeff.**	***t* stat.**	
	Constant	-103.81	-2.12	**
	IPOSZ	1.75	41.91	***
	AHAT	79.85	1.06	
	SD	1828.72	11.65	***
Adjusted R^2		0.8389		

** Significant *t* statistics at the 5 percent level
*** Significant t statistics at the 1 percent level

If H_7 is true, we expect a positive sign on OWNSHP. But our OLS regression result in table 4.8 reports, on the contrary, a significant (at 5% level) and negative coefficient for OWNSHP, our proxy for issuer's fractional ownership at IPOs. This indicates that Grinblatt and Hwang's bivariate signaling model does not stand in the Chinese *A*-share market either.

Table 4.8 First OLS regression to test Grinblatt and Hwang's Bivariate Signaling Model

Dependent Variable:	**IR**			
Explanatory Variables:		**Coeff.**	***t* stat.**	
	C	0.11	1.15	
	OWNSHP	-0.31	-2.34	**
	SD	10.18	87.56	***
Adjusted R^2		0.9573		

** Significant *t* statistics at the 5 percent level
*** Significant *t* statistics at the 1 percent level

Model 1 in Table 4.9 gives the OLS regression results for equation (8). We can see that V is very insignificant in explaining IR. This again proves that Grinblatt and Hwang's signaling model does not stand in the Chinese market during the sample period. Table 4.10 presents the first regression of Hausman test for the exogeneity of variable V. We take the residual of the regression in table 4.10 as VRESID and add it as one more explanatory variable into equation (8). Model 2 in table 4.9 shows the

result. The insignificant coefficient for VRESID indicates that V is exogenous in equation (8). Using the same Hausman test, I find that OWNSHP is exogenous too (results not reported here). So the spurious correlation and simultaneous bias problem has been eliminated.

Table 4.9 Second OLS regression to test Grinblatte and Hwang's Bivariate Signaling Model

		Model 1		Model 2	
Dependent Variable:	***IR***				
Explanatory Variables:		**Coeff.**	***t* stat.**	**Coeff.**	***t* stat.**
	C	0.11	1.13	0.11	1.11
	V	0.01	0.37	-0.04	-0.78
	OWNSHP	-0.31	-2.33 **	-0.30	-2.26 **
	SD	10.18	87.12 ***	10.20	86.21 ***
	VRESID			0.05	0.90
Adjusted R^2		0.9572		0.9577	

** Significant *t* statistics at the 5 percent level
*** Significant *t* statistics at the 1 percent level

Table 4.10 First regression of Housman test for the exogeneity of variable V

Dependent Variable:	***V***			
Explanatory Variables:		Coeff.	*t* stat.	
	Constant	0.17	1.45	
	LNAGE	-0.01	-0.13	
	Y2ROA	0.00	0.73	
	NK	-0.16	-3.34	***
	STKCDSH	0.12	1.51	
	IN0002	0.18	1.09	
	IN0003	-0.62	-1.39	
	IN0004	0.06	0.49	
	IN0006	0.17	1.11	
	Y96	0.00	0.02	
	Y97	-0.10	-0.98	
Adjusted R^2		0.0350		

** Significant *t* statistics at the 5 percent level
*** Significant *t* statistics at the 1 percent level

Group 2 - Linkages between IPOs and Seasoned Equity Offerings

Table 4.11 presents the logit regression test for the relation between IPO underpricing and the probability of seasoned equity issue (equation (9)). The slope coefficient (*t*-statistics) on the variable *IR* is –0.07 (–0.40). The slope coefficient for *AFTRTN* (*t*-statistics) is 0.86 (3.97). For $\boldsymbol{H_{10}}$, the signaling hypothesis expects a positive and significant role of IPO initial return in explaining the likelihood of issuing subsequent equity offerings. However, I find a negative and insignificant coefficient for the initial returns. This suggests that the signaling model does not stand. At the same time, the estimates show a strong relation between the after-market price appreciation and the likelihood of SEOs. In other words, the coefficient for *AFTRTN* suggests that the higher the after-market returns, the more likely the listed firm re-issue. This is consistent with the market feedback hypothesis. Other two significant variables are *Y*96 and *Y*97, which means that IPOs in 1996 and 1997 are more likely to issue SEOs than those in 1998. This is probably because IPOs in 1996 and 1997 have longer time for SEOs than those in 1998. The rest of the dummy variables are insignificant and their coefficients are jointly not different from zero. Therefore, I report a second logit regression excluding those insignificant dummy variables in Model 2 of table 4.11. Model 2 reflect almost the same result as that of model 1 except that the significance level for dummy variable *Y*96 decreases.

Table 4.11 Logit Model to Test the relation between underpricing and the likelihood of SEO

Dependent Variable:	**SEOD**	**Model 1**			**Model 2**		
Explanatory Variables:		**Coeff.**	***t* stat.**		**Coeff.**	***t* stat.**	
	Constant	4.05	0.88		3.02	0.67	
	IR	-0.07	-0.40		-0.07	-0.40	
	AFTRTN	0.86	3.97	***	0.81	3.89	***
	LOG(IPOSZ)	-0.23	-1.00		-0.17	-0.77	
	Y96	1.02	2.61	***	0.98	2.53	**
	Y97	1.46	4.78	***	1.39	4.69	***
	IN2	-0.12	-0.25				
	IN3	1.52	1.20				
	IN4	0.16	0.45				
	IN6	-0.90	-1.95				
	STKCDSH	0.16	0.67				

Note:
1. 215 observations with Dep=1, total observations is 343.
2. ** Significant *t* statistics at the 5 percent level
   *** Significant *t* statistics at the 1 percent level

The right censoring Tobit regression examining $\boldsymbol{H_{11}}$ is presented in table 4.12. The slope coefficient estimate for *IR* is 0.04, with $t = 0.83$. The sign of *IR* is opposite to our expectation and the *t*-statistics is insignificant. This again shows that the signaling model does not stand in the Chinese market. The coefficient for *AFTRTN* is negative (–0.17) and statistically different from zero at the 1% level ($t = –4.42$). This result indicates that firms that experience large price appreciation after the IPOs are likely to raise larger amounts of capital through seasoned equity issues. This is again consistent with the market feedback hypothesis.

Table 4.12 Tobit Regression to Examine the relationship between Time SEO and IPO Unperpricing

Dependent Variable:	***LNTIMESEO***			
Explanatory Variables:		**Coeff.**	***t* stat.**	
	Constant	7.44	6.98	***
	IR	0.04	0.83	
	AFTRTN	-0.17	-4.42	***
	LOG(IPOSZ)	-0.01	-0.21	
	Y96	-0.38	-4.18	***
	Y97	-0.35	-4.85	***
	IN2	0.09	0.83	
	IN3	-0.40	-1.34	
	IN4	-0.05	-0.62	
	IN6	0.28	2.49	**
	STKCDSH	0.00	0.07	
Adjusted R^2		0.1248		

Note:
1. Total observations are 343 and right-censored observations are 128.
2. ** Significant *t* statistics at the 5 percent level
*** Significant *t* statistics at the 1 percent level

Model 1 of table 4.13 reports the Tobit regression estimates examining the relation between the size of the seasoned offerings and the explanatory variables (equation (11)). The estimate (*t*-statistic) of the slope coefficient for the variable *IR* is 0.02 (0.15), which indicates that the excess initial returns in the IPOs are weak in explaining the relative SEO size and $\boldsymbol{H_{12}}$ is rejected. Same as the previous logit regression, I find a positive (0.46) and significant (t = 4.84) coefficient for *AFTRTN*. Consistent with my previous findings, the market feedback hypothesis is verified for the Chinese *A*-share market. The tobit regression also shows that *IPOSZ* is negative (–0.37) and significant (t = –2.85) in explaining the relative SEO size. The coefficients (*t*-statistics) for year dummy variables *Y*96 and *Y*97 are 0.6 (2.67) and 0.72 (3.97), respectively, indicating that the IPOs in 1996 and 1997 raise higher amount of capital through seasoned equity issues than the IPOs in the year 1998. Another significant dummy variable is *IN*6 suggesting that commercial firms raise

smaller amount of capital in SEOs than industrial firms. There is no statistical difference in the two stock exchanges. Therefore I report a second Tobit regression excluding *STKCDSH* in model 2 of table 4.13, which shows almost the same results as those of model 1.

Table 4.13 Tobit Regression to Examine the relationship between SEO Size and IPO Unperpricing

Dependent Variable:	**SEOSZ/IPOSZ**	**Model 1**			**Model 2**		
Explanatory Variables:		**Coeff.**	***t* stat.**		**Coeff.**	***t* stat.**	
	Constant	7.05	2.68	***	7.08	2.69	***
	IR	0.02	0.15		0.02	0.15	
	AFTRTN	0.46	4.84	***	0.46	4.82	***
	LOG(IPOSZ)	-0.37	-2.85	***	-0.38	-2.87	***
	Y96	0.60	2.67	***	0.60	2.67	***
	Y97	0.72	3.97	***	0.72	4.01	***
	IN2	0.25	0.88		0.23	0.83	
	IN3	1.04	1.41		1.06	1.43	
	IN4	-0.05	-0.25		-0.06	-0.32	
	IN6	-0.54	-2.00	**	-0.54	-1.99	**
	STKCDSH	-0.07	-0.49				
Adjusted R^2			0.1440			0.1434	

Note:
1.Total observations are 343 and left censored observations are 128.
2. ** Significant *t* statistics at the 5 percent level
*** Significant *t* statistics at the 1 percent level

To examine the relation among the stock-price response to the announcement of seasoned equity offerings, underpricing and after-market returns, I first use a sub-sample of 215 IPOs with subsequent offerings to run the OLS regression. The results are presented in model 1 of table 4.14. The estimated coefficient for *IR* is positive, as expected, but statistically insignificant ($t = 1.69$)[18]. This indicates that underpricing the IPO does not significantly mitigate the negative share-price response to a first seasoned equity offering. The estimate of the coefficient for the variable *AFTRTN* is

[18] Another regression excluding insignificant dummies from model 1 has been done; the result is of no difference from model 1. Therefore it is not reported here.

also not significantly different from zero. The rest of the explanatory variables are insignificant. The adjusted R^2 is 0.0089, which shows that the regression has very weak explanatory power. This is not surprising in the Chinese market because the seasoned equity offering news is normally leaked out long time before the publication of the SEO announcement. Usually months before a re-issuance, a board meeting is held to discuss the re-issuance decision and the meeting resolution is published the next day after the meeting. Therefore, by the time of SEO prospectus publication, the SEO news is not new and the stock price has already adjusted.

Model 1 of table 4.14 examines only 215 firms with their first SEOs within 3 years of IPO. This is only a subset of our larger population. The decision to make subsequent offerings is endogenous, which is not reflected in the cross-sectional estimates of model 1. Therefore the estimator may be inconsistent as a result of truncation bias. Eckbo et al. (1990) derive consistent estimators using a latent variable model. These estimators account for the presence of the potential truncation bias. Michaley and Shaw (1994) use this method to detect the dividend announcement effect. We also adopt the same model to further examine $\boldsymbol{H_{13}}$.

Firstly, a probit regression is estimated as followings:

$$SEOD = Z\gamma + \varepsilon$$

where Z denotes the independent variables, which are *IR, AFTRTN,* Ln*(IPOSZ), Y*96 and *Y*97. They are related to the likelihood that a SEO will be issued. Then we calculate the Mill's ratio *MILLSRATIO* as $\varphi(Z\gamma)/\Phi(Z\gamma)$, where φ is the normal density function and Φ is the normal cumulative distribution function.

By adding *MILLSRATIO* as one more explanatory variable into equation (12), consistent parameters can be obtained:

$$REACT = \beta_0 + \beta_1 IR + \beta_2 AFTRTN + \beta_3 \ln IPOSZ + \beta_4 Y96 + \beta_5 Y97 + \beta_6 IN2 + \beta_7 IN3 + \beta_8 IN4 + \beta_9 IN6 + \beta_{10} STKCDSH + \beta_{11} \ln TIMESEO + \beta_{12} \ln SEOSZ + \beta_{13} SEOSZ / MKT + \beta_{14} SEOPRC / TRDPRC + \beta_{15} MILLSRATIO + \varepsilon \quad (13)$$

The estimation result of equation (13) is presented in model 2 of table 4.14. Same as our regression in model 1, the slope coefficient for *IR* and *AFTRTN* are still insignificant. This verifies the fact that more underpriced IPOs do not experience a less unfavorable price reaction to SEO announcement than firms with less underpriced IPOs. Thus $\boldsymbol{H_{13}}$ is rejected.

In summary, the relations between IPOs and SEOs activities in the Chinese market are mainly caused by the after-market performances of stocks instead of the issuer's signaling behavior. The signaling hypothesis does not stand in the Chinese *A*-share market, while the market feedback hypothesis is supported.

Table 4.14 OLS Regression to Test the Price Reaction at the Announcement of SEO

Dependent Variable:	**REACT**	**Model 1**			**Model 2**		
Explanatory Variables:		Coeff.	*t* stat.		Coeff.	*t* stat.	
	Constant	-0.35	-1.98	**	-0.09	-1.04	
	IR	0.01	1.69		0.00	1.59	
	AFTRTN	0.00	0.12		0.00	0.41	
	LNIPOSZ	0.00	0.51		0.00	0.94	
	Y96	0.02	1.61		0.01	0.82	
	Y97	0.00	-0.08		0.00	0.08	
	IN2	-0.01	-0.76		0.00	-0.40	
	IN3	0.04	1.14		0.03	1.12	
	IN4	-0.01	-1.06		-0.01	-0.99	
	IN6	-0.01	-1.03		-0.01	-0.86	
	STKCDSH	0.00	-0.19		0.00	-0.37	
	LNTIMESEO	0.02	0.81		0.00	-0.03	
	LNSEOSZ	0.02	1.54		0.00	0.44	
	SEOSZ/MKT	-0.03	-1.25		-0.01	-0.85	
	SEOPRC/TRDPRC	-0.04	-1.71		-0.04	-2.29	**
	MILLS RATIO				0.00	0.22	
Adjusted R^2			0.0089			0.0177	

Note:
1. Number of observations for model 1 is 215 and model 2 is 343.
2. ** Significant *t* statistics at the 5 percent level
   *** Significant *t* statistics at the 1 percent level

Chapter 5 Conclusions

This study examines the degree of underpricing for 343 online fixed price offerings from November 1995 to December 1998. The initial return is on average 123.59%, much lower than the level in early 1990s reported in previous studies. This indicates that the efficiency in the primary market has improved. However, it is still larger than what is found in most emerging markets.

I investigate possible explanations for the level of underpricing. I analyze possible explanations for the Chinese market according to the characteristics of the Chinese market and examine all major models, i.e., the winner's curse model, the ex ante uncertainty explanation and the signaling model.

Consistent with the winner's curse model, after adjusting for rationing, uninformed investors in the Chinese market essentially break even. The negative relation between the initial returns and the allocation rates to investors also suggest that Chinese individual investors face the winner's curse problem. Using several proxies for ex ante uncertainty, I find ex ante uncertainty has very high explanatory power in explaining the Chinese IPO underpricing. This is consistent with Mok and Hui (1998)'s assertion.

After an extensive examination of 8 hypotheses of the signaling model, I conclude that the signaling model does not stand in the Chinese market. Evidence shows that the relations between IPO underpricing and SEO activities are caused by the market feedback information. This is contrary to Su and Fleisher (1999)'s findings.

In all, the main reasons for the Chinese *A*-share IPO underpricing are investor's high level of ex ante uncertainty about IPO value and the winner's curse problem. As I

have eliminated the possibility of the principal-agent and the signaling explanation, I conclude that the positive relation between ex ante uncertainty and underpricing is evidence in support of the winner's curse problem. This suggests that reducing issuing firms' ex ante uncertainty, such as through more information disclosure from IPO firms, will help to ameliorate the winner's curse problem and thereby lower the level of underpricing.

Given the prominence of the Chinese stock market in the emerging markets, the results in this paper should be able to shed some light on explanations of IPO underpricing in other emerging markets. The results add more evidences on testing of winner's curse model, the ex ante uncertainty explanation and the signaling model as well. This should be illuminating and of value to both academicians and practitioners.

Appendix A: Offering Mechanism Changes in China

In China, almost all new issue offerings before 2001 are fixed price offerings (The offer price in the fixed price offering is chosen according to the formula of taking the after tax profits per share multiplied by a price earning ratio). But the fixed price offerings are not the same in their share allocations. There has been an overwhelming demand[19] of new issue stocks in the Chinese market due to the few investment opportunities and the high saving rate for the public. Therefore, how to distribute a fixed amount of shares is a problem from the outset. As the Chinese stock market develops, share allocation methods have gone through many stages of reforms. I will discuss five of the most commonly used methods in the past ten years.

1. Limited lottery forms

In 1991 and 1992, there was a lottery system with a pre-announced fixed number of lottery forms. The maximum number of lottery forms each individual investor could purchase was also fixed. Winners of the lottery could purchase a designated number of shares per form. Thus, investors knew the odds of winning the lottery in advance. But the limited lottery forms relative to an overwhelming demand of IPO and widespread corruption caused a social chaos in Shenzhen in August 1992.

[19] Over 95% of IPOs in China are oversubscribed

2. Unlimited lottery forms

In 1993, when Tsingtao Brewery got listed, a method of selling unlimited number of lottery forms was first used. Investors in this case could purchase as many lottery forms as they desired. This is a fairer method than that of selling limited forms, yet many shortcomings still exist such as high cost and low efficiency. A big amount of money is spent on the printing of application forms while the issuer cannot raise more funds from it.

3. Unlimited number of deposit certificates

In August 1993, the authorities announce that issuing firms can use a new offering method called unlimited number of deposit certificates. The deposit certificate here is a fixed maturity, fixed amount and specially designed deposit certificate. The ballot ratio in this case is decided by number of certificates sold, number of shares each deposit certificates are entitled to and number of shares publicly offered. Although this method saves social cost in printing the unlimited lottery forms, it causes a large amount of social deposit savings move around the country. Large amount of cash flows into banks where a new issue is offering. When the new issue is over, investors must go to the banks to get back their defrozen funds. This is extremely inconvenient.

4. Full payment and pro rata allocation

In this method, investors were required to deposit a certain quantity of funds into a special saving account when submitting an application for shares, which could not be withdrawn until the lottery was completed. These special saving accounts were given relatively low interest. And losers have to wait a long time for funds to be repaid.

5. Online fixed price offerings (Shang Wang Ding Jia)

In 1994, another share allocation mechanism was introduced in which investors bid for quantities, with pro-rata allocation in the event of oversubscribed shares. This method is the same as the full payment and pro rata allocation except that all transactions happen here use the existing stock exchange trading system. Investors again need to pay a deposit but with prompt repayment for unsuccessful applicants. It has proved a more efficient procedure and meets with the approval of investors. This is also the most commonly used offering method in the past 10 years.

Table A provides a summary statistics on the allocation methods adopted for A-share IPOs from 1990 through 2000 (financial firms and closed end funds are excluded).

Table *a*: Statistics on the allocation methods adopted in the Chinese *A*-share market from 1990 through 2000

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Total
1 & 2	0	7	49	53	13	2	0	0	0	0	0	124
3	0	0	0	3	6	1	4	2	0	0	0	16
4	0	0	0	1	1	1	49	59	5	0	0	116
5	0	0	0	0	0	6	120	125	97	91	73	512
Other methods	8	1	22	3	3	2	0	0	0	2	64	105
Not disclosed	2	4	9	63	13	0	0	0	0	0	1	92
Total	10	13	80	123	36	12	173	186	102	93	138	965

Note: 1 &2 Limited or unlimited lottery forms; 3 Unlimited number of deposit certificates; 4 Full payment and pro rata allocation; 5 Online fixed price offering (Shang Wang Ding Jia)
Source: Haitong Securities

Appendix B Correlation Matrix

Table *b*: Correlation matrix of continuous explanatory variables in equation (4)

	IR	SD	LNAGE	LNIPOSZ	BFMARRTN	OWNSHP	LAG
IR	1.00						
SD	0.98	1.00					
LNAGE	0.01	0.07	1.00				
LNIPOSZ	-0.28	-0.33	-0.28	1.00			
BFMARRTN	0.11	0.13	0.14	-0.30	1.00		
OWNSHP	0.00	0.03	-0.07	0.03	-0.07	1.00	
LAG	0.20	0.18	-0.12	0.09	-0.23	0.02	1.00

Table *c*: Correlation matrix of continuous explanatory variables in equation (6)

	V1	IPOSZ	AHAT	SD
V1	1.00			
IPOSZ	0.88	1.00		
AHAT	-0.11	-0.14	1.00	
SD	0.03	-0.25	-0.01	1.00

Table *d*: Correlation matrix of continuous explanatory variables in equation (10)

	IR	AFTRTN	LNIPOSZ
IR	1.00		
AFTRTN	-0.09	1.00	
LNIPOSZ	-0.28	-0.19	1.00

Table *e*: Correlation matrix of continuous explanatory variables in equation (12)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) IR	1.00						
(2) AFTRTN	-0.14	1.00					
(3) LNIPOSZ	-0.22	-0.23	1.00				
(4) LNTIMESEO	0.26	-0.08	-0.06	1.00			
(5) LNSEOSZ	-0.18	0.05	0.51	-0.01	1.00		
(6) SEOSZ/MKT	-0.19	-0.17	-0.03	-0.15	0.48	1.00	
(7) SEOPRC/TRDPRC	-0.04	-0.32	0.37	0.19	0.21	0.13	1.00

Appendix C Test of the Winner's Curse Model

Table f: OLS Regression to Test the Winner's Curse Model

Dependent Variable:	IR			
Explanatory Variables:		Coeff.	t stat.	
	Constant	-0.79	-2.89	***
	BALLOTT	-0.06	-5.10	***
	SD	10.11	82.83	***
	LNAGE	-0.03	-3.36	***
	LNIPOSZ	0.04	2.85	***
	BFMARRTN	0.00	-0.06	
	OWNSHP	-0.41	-3.36	***
	LAG	0.00	1.13	
	STKCDSH	0.04	2.00	**
Number of observations		343		
Adjusted R^2		0.9644		

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